MODERN PLASTICS

JULY 1955

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FACTS ON PHENOLICS

- **When you're looking into materials and need factual information —**
- **When you're thinking of plastic parts for industrial products —**
- **When you're planning design changes to improve whatever you make —**

You can save a lot of time by having up-to-date physical property data on Durez phenolics—the *industrial plastics* —in this handy pamphlet form.

Our new "Phenolic Molding Materials" tells you quickly what you need to know, including specific property values on a number of materials in each of the several basic groups of phenolics. We'll gladly send you a copy... more than one if you need it.

DUREZ

PHENOLIC PLASTICS
for the new Competitive Era

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Please send me your "Phenolic Molding Materials-Physical Properties by Classified Groups."

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"The *Talk* of the Toy World"

—*Big, New* **REMCO** *Mobile Loudspeaker* **clearly bespeaks** *the molded strength of* Catalin HIGH IMPACT Styrene

Remco Industries Inc. heralds this toy wiz . . *this* whopping 6-wheel tractor-trailer — as an "Electronic Mobile Loudspeaker and Signal System". We see it as an all-curtain-penetrating sensation . . . the "Voice of America Jr.".

Measuring 24 inches from tip to tail, each inch of its super-length is molded of super-strength CATALIN High Impact STYRENE and includes cab housing, revolving searchlight, control panel switches, loudspeaker, adjustable mounting, chassis and remote-action microphone. Furnished with 4 batteries and wire, the unit is ready to roll into action!

In enthusiastically acclaiming the completed toy as "one of great and powerful impact", Remco Industries is mindful that, materially, *the gem of plastics* shared in achieving this *high impact* quality level. "Come in, Voice of America Jr., the air's now yours . . Roger . . Over".

**Product of Remco Industries, Inc., 113 No. 13th Street, Newark, N. J.*

CATALIN CORPORATION OF AMERICA
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Catalin

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations

MODERN PLASTICS*

July 1955 • Vol. 32 No. 11

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Modern Plastics, published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Modern Plastics Encyclopedia Issue published as second issue in September by Plastics Catalogue Corp., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the Act of March 3, 1879. Modern Plastics is regularly indexed in Industrial Arts Index and Industex. Subscription rates: U.S., its possessions, and Canada, $6.00 for one year, $11.00 for two years, $15.00 for three years; Pan-American countries, $8.00 for one year, $13.00 for two years, $17.00 for three years; all other countries $12.00 for one year, $20.00 for two years, $28.00 for three years, payable in U.S. currency. Single copies $0.75 each in the United States, its possessions, and Canada; all other countries, $1.25 (except the September Encyclopedia Issue, which is not sold separately). Printed in the U.S.A., by Hildreth Press, Inc., Bristol, Conn.

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B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not manufacture these garages. We supply only the Geon paste resin.

Low-cost housing project for America's cars

THIS easy-to-install garage covers your car end to end, from top to ground, and by protecting the finish against sunlight, dew, or salt air preserves the value of the car. The manufacturer has built years of service into this product by using steel tube construction and the rugged qualities of nylon fabric coated with a durable Geon based plastisol.

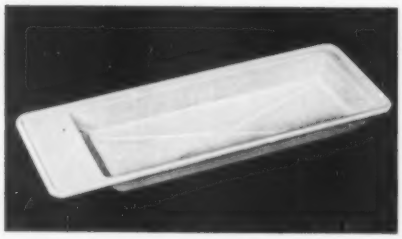
The Geon coated fabric has high tensile strength, yet is light in weight —same type material used by the U. S. Army for ponchos and arctic tent shelters. It fights off sunlight, is unaffected by salt and sand, will not crack, and remains pliable even in cold weather.

Other new and profitable uses for Geon polyvinyl materials are within the whole range of American industry. You'll find Geon in soft sponge, noncorrosive rigid piping, greaseproof paper coatings, moisture-proof insulation for wire, and in hundreds of other products. Your own business may base its next sales success on the remarkable properties of Geon. For more information, please write Dept. R-7, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

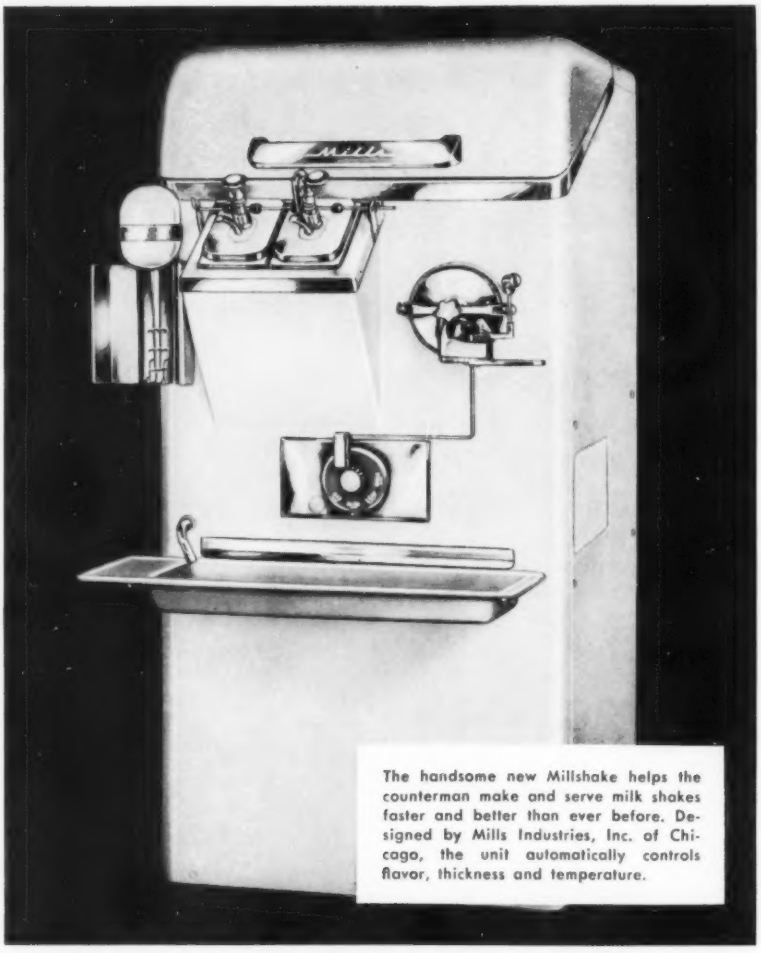
GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

The top cover, formed of Campco by Arrem Plastics of Chicago, harmonizes with metal surface of the cabinet, yet it's so light even a child can lift it.



The drip tray is light blue Campco to provide a pleasing contrast with the white metal cabinet.



The handsome new Millshake helps the counterman make and serve milk shakes faster and better than ever before. Designed by Mills Industries, Inc. of Chicago, the unit automatically controls flavor, thickness and temperature.

How CAMPCO met 5 design requirements on the new Millshake

Several times a day, the drip tray of this new milk shake dispenser must be removed, cleaned and replaced quickly. The hinged top cover must also be cleaned ... but more important, it must provide an air-tight seal for the unit's refrigerated compartment.

That's why Mills Industries insisted that both parts have these five characteristics: (1) easy to clean, (2) easy to lift, yet (3) strong enough to take rough handling. What's more, (4) the cover – an inner and outer shell enclosing an insulation material – had to be easy and economical to manufacture to close tolerances ... and both parts (5) had to look clean and sanitary and harmonize with the gleaming metal surface of the cabinet itself.

Mills Industries found Campco S-300 rubber-styrene sheet ideal. It offers an easy-to-clean, porcelainlike finish in a wide range of colors ... excellent dimensional stability ... low moisture absorption ... and high impact strength. And this sheet can be formed quickly and economically to complex shapes ... on simple machines ... by practically any conventional forming technique.

Why not try Campco yourself? Ask one of our engineers for samples to try in your own plant. Or, if you prefer, write for literature first.

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Chicago Molded Products Corporation

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Chicago 35, Illinois

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Company_____

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EDITORIAL

Important Day for Plastics

This piece is being written on April 29th, as the sale of government-owned synthetic rubber plants to 52 private companies is completed. The date marks the largest commercial plastics development in our history—because various synthetic rubbers are alloyed with various plastics resins to form important new materials, and because some plastics and some synthetic rubbers are produced from the same basic materials.

We believe the deal was a good one from the standpoints of the national interest, of the taxpayer, of small and large industry, and of the consumer.

Plants which originally cost $488,584,000, have a present book value of $131,954,000, and sold for $285,465,000. To get more than twice the book value of plants twelve years old, and sixty cents on every dollar of original cost, is a nice piece of trading for which the taxpayer should be grateful.

By contract of sale, national security in synthetic rubber availability is assured. Also by the terms of the deals monopoly is prevented and smaller industrial consumers—including many plastics companies—will have available to them fully 50% more synthetic rubber than they now consume.

Five things are now going to happen.

1) Under competitive circumstances the companies involved will pour money and effort into new research to produce new and better rubbers and plastics.

2) The output of these plants will now have to be sold competitively; so costs and operating efficiencies will be most carefully watched while market development and promotion will be used to build the business.

3) Demand from each company's industrial customers for broader ranges of materials will force all to become more versatile, to produce several kinds of synthetic rubbers.

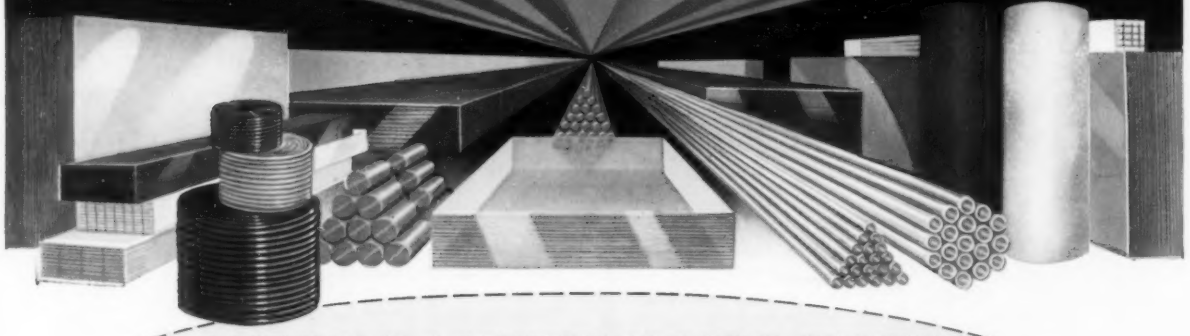
4) The profits of these enterprises will now be subject to tax, and the losses, if any, will be borne by the investors, not by the public.

5) Private ownership of these plants and operation in a competitive market will have a stabilizing effect on the natural rubber market.

The Congress and the Disposal Commission are to be congratulated on the manner in which the whole project was handled.

Public Law 205 is a complete and careful piece of legislation and should establish a pattern for future removal of governments from any field of industrial monopoly into which they may move. The Commission, despite pressure from various sources, lived up to the letter of that law. The result will mark April 29, 1955 as a most important date in the history of the industrial development of America under free enterprise.

PLEXIGLAS
VINYLITE
ACETATE
NYLON



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ALSO MANUFACTURERS OF "CADCO" CAST ACRYLIC RODS AND TUBES

"Cadco" is available in a wide variety of transparent and lustrous colors and in diameters up to 24 inches. "Cadco" is famous for its optical clarity, strength, its ease of machining into any design, shape or form. Its almost indestructible nature gives it an unlimited range of possible applications.

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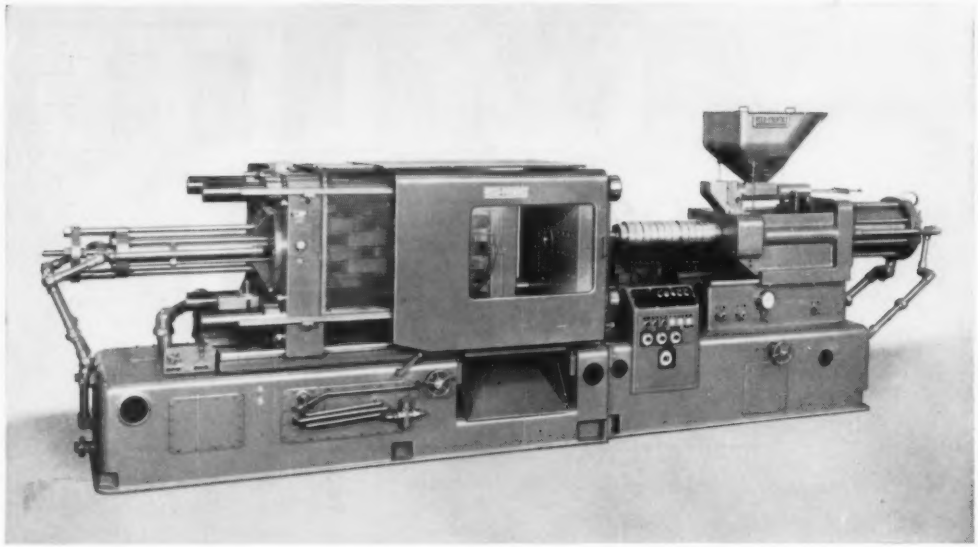
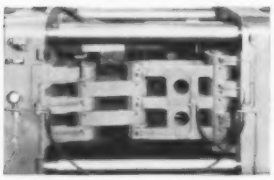
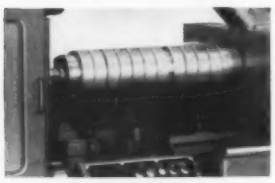
NEW 400T-16/20 oz. "REED"



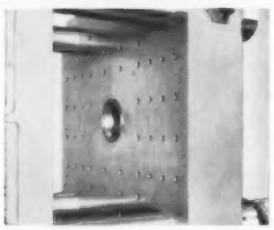
extra molding capacity through multiple strokes



400 TONS CLAMPING PRESSURE
Powerful toggle mechanism develops 400 tons positive mechanical mold locking pressure to hold large area jobs.



HIGH PLASTICIZING CAPACITY
Newly designed heating cylinder plasticizes 125 lbs. of thermoplastic material per hour and simplifies heater maintenance



36" x 38" MOLD PLATENS
Four tie bars, 4½" diameter each, support large mold platens which give projected casting area of 200 sq. in.

New! Reed-Prentice introduces the new 400T-16/20 oz. plastic injection molding machine, engineered to combine "REED" ruggedness with speed and *extra molding capacity*. A new built-in stuffing arrangement produces shots above the rated capacity of 20 oz. through multiple strokes.

And the 400T-16/20 oz. "REED" gives you greater production. It dry cycles at 250 shots per hour. Optional low pressure die closing unit assures mold protection in full automatic operation.

FREE! Want full details on the 400T-16/20 oz. "REED"? Write today for Bulletin 1620.

The world's largest builders of plastic injection molding machines

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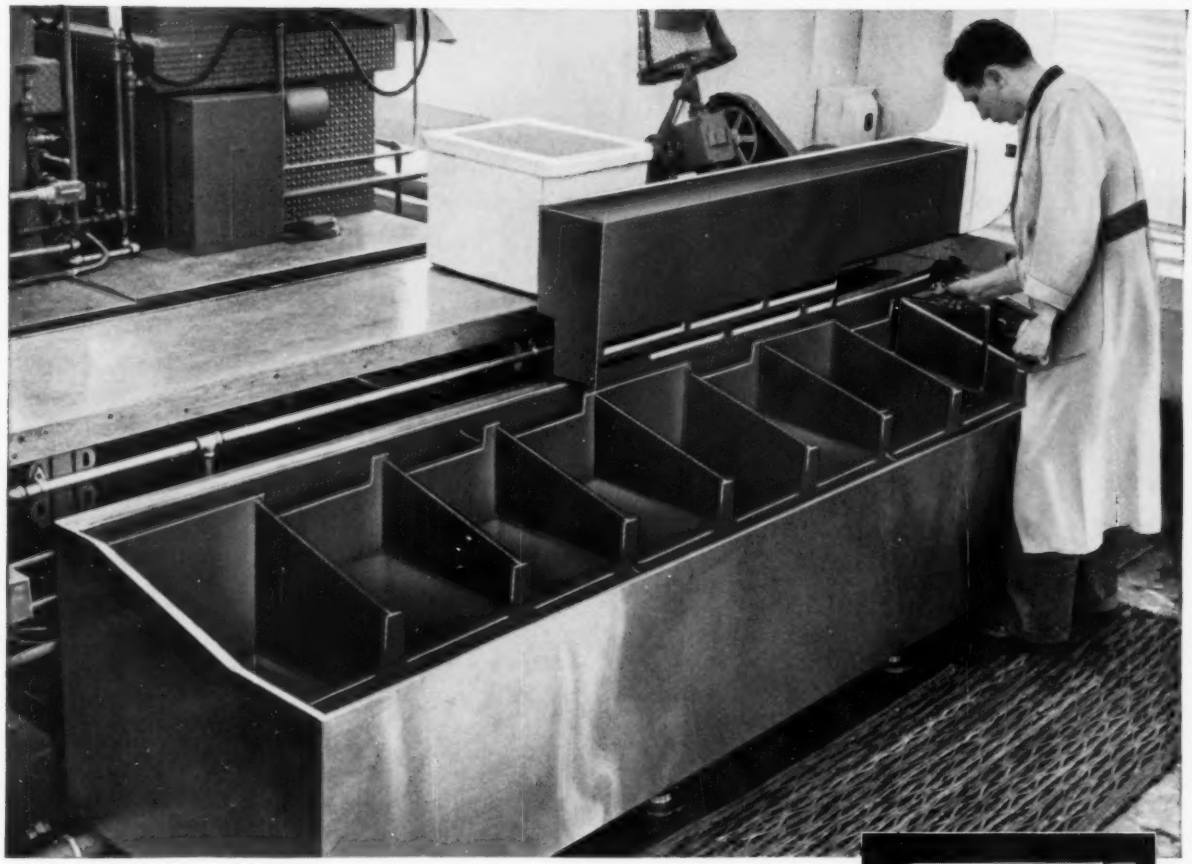
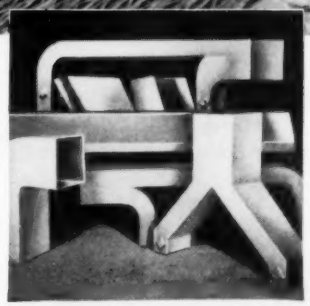


Bulova Curbs Corrosion

of plating equipment with reinforced plastic tanks of Celanese Marco* Resins*



Top—Plating Tanks designed by Bulova Watch Company, manufactured by Schori Process Division of Ferro-Co Corp., Long Island City, New York.

Above—Two other products of the versatile new Schori Process.

Four plating tanks were recently installed at Bulova Park, L. I.

They're close to steel in structural strength—but weigh only a fifth as much.

They're impervious to attack by many "problem" chemicals . . . they won't rust or dent.

These Bulova tanks measure 10'x3'x3', have 12 compartments, plumbing inlets, drains, attachments and ventilating ducts—but they could be almost any size, shape, or specification.

They are examples of reinforced plastic construction with Marco polyester resins and low-cost fabricating methods.

If you are faced with a manufacturing problem . . . if you are designing a new product . . . chances are that reinforced plastic construction can help you. Write for the latest facts on special formulations and methods, to Celanese Corporation of America, Plastics Division, Dept. 101-G, 290 Ferry Street, Newark 5, N. J. Canadian affiliate, Canadian Chemical Co., Limited, Montreal, Toronto and Vancouver.

Celanese*

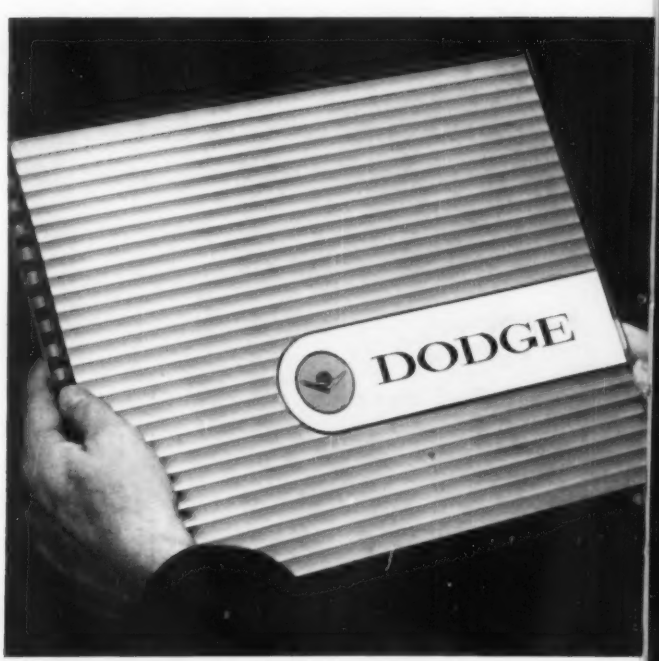
PLASTICS and RESINS

*Reg. U. S. Pat. Off.

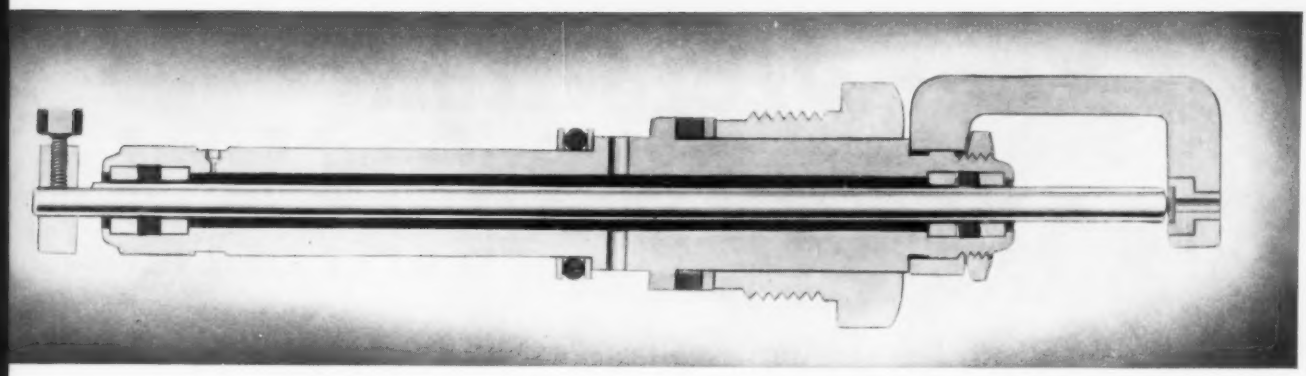
4 more examples of

ZYTEL ® was chosen for the handle on this new dishwasher because it is easy to clean, corrosion-resistant, a low conductor of heat.

ALATHON ® molded into a lightweight case for diagnostic instruments, absorbs shock, can be sterilized.



LUCITE ® enhances the beauty of this brochure, makes a durable cover which retains its attractive appearance.



TEFLON® is an ideal engineering material for bearings that will prevent freezing.

advanced product engineering

Designers and molders have a wide-open field for product improvement—utilizing the unique combination of properties of the Du Pont engineering materials. The following case histories are typical:

"ZYTEL" nylon resin is now used for the handle on this dishwasher that gives a surge of aerated suds or clear water at the press of a button. The manufacturer specifies "Zytel" for this handle for several important reasons. It can be molded economically, assembled easily. Other advantages are its attractive appearance, lightness, resistance to moisture, corrosion and breakage. And because "Zytel" is a low heat conductor, it can be handled comfortably. (Dishwasher manufactured by the Manville Manufacturing Corporation, Pontiac, Michigan.)

"ALATHON" polyethylene resin is molded into this smartly tailored case for diagnostic instruments. The external case is exceptionally light in weight, has a self-hinge and patented one-piece construction. Supporting ribs make it shock-proof; and the integral hinge, overlapping fasteners and molded tab ends insure dust-free storage. Because "Alathon" resists chemical attack, the entire case may be washed or sterilized with standard germicides. (Case molded by Auburn Button Works, Inc., Auburn, New York, for Welch Allyn, Inc., Skaneateles Falls, New York.)

DU PONT

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BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

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"LUCITE" acrylic resin can be utilized for many unusual decorative effects. For example, the Dodge Division of Chrysler Corporation was looking for a durable material, adaptable to superior styling, to cover their sales album. The album, which won several art awards, employed a cover of Du Pont "Lucite." This beautiful material has excellent impact strength, retains its sparkling clarity for years. It is economically fabricated by several efficient techniques. (Cover molded by Kent Plastics Corporation, Evansville, Indiana.)

"TEFLON" tetrafluoroethylene resin solved a design problem for a manufacturer of instruments measuring differential pressure. The instrument manufacturer reports that these bearings of "Teflon" (see cutaway view) readily withstand working pressures involved. "Teflon" is resilient enough to prevent leakage by close conformation to the stainless-steel shaft. The low-friction characteristics of "Teflon" permit easy operation without lubrication, and prevent freezing. Bearings of "Teflon" will not cause pitting of the shaft. (Manufactured by Taylor Instrument Companies, Rochester, New York.)

Evaluate these Du Pont engineering materials in terms of your own design problems. For complete information, use the coupon below, or write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 307, Du Pont Building, Wilmington 98, Delaware.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept., Room 307, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec

Please send me more information on the Du Pont engineering materials checked: ☐ "Lucite"* acrylic resin; ☐ "Zytel"* nylon resin; ☐ "Teflon"* tetrafluoroethylene resin; ☐ "Alathon"* polyethylene resin. I am interested in evaluating these materials for

_____

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to enable Printing, Decorating, or Glue Sealing is available to all

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George W. Traver U.S. Application, for Method and Means for Treating Non-Adherent Surfaces to Render Them Adherent

M. F. Kritchever Canadian Patent No. 501,937

George W. Traver Canadian application, for Method and Means for Treating Non-Adherent Surfaces to Render Them Adherent

(Foreign Patents and Applications upon request)

A full line of engineered equipment is available to all Licensees. The equipment for treatment of film may be had in models permitting treatment by *either* electron bombardment or flame contact, under above patent material, readily changeable from one to the other, according to requirements at the moment. Precision regulation of treatment values is obtained through simple controls. All speeds applicable to slitters, presses, or extruders are available, and the treatment is intended to be carried out as part of any operation prior to or part of printing, without handling or labor costs.

Formed articles such as bottles, tubes, pipe, housewares, lids, toys, and wire can be made highly receptive to inks, paints and adhesives at any production rate required, and treatment can be carried out as part of the present production process, without additional labor. Operational and maintenance costs are considered negligible by our Licensees. No special inks or adhesives are required for permanent adhesion under severest conditions.

All persons and firms who desire to use the processes, or who may presently be using either or both processes, are hereby notified that to do so without license from the undersigned under existing patents constitutes infringement, and that the fullest remedy under law will be pursued against infringers.

for information, write to:

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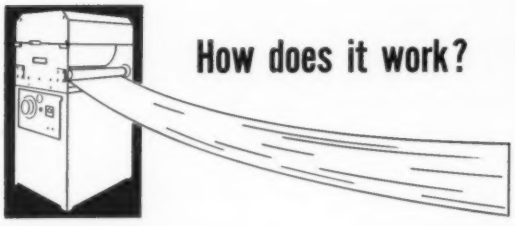
The newest unit to make Polyethylene Printable

It's the MPM-Traver unit. It's electronic. It's simple to operate. It applies the most advanced technique yet designed to give polyethylene film a surface that readily accepts printing.

What are the main features of the MPM-Traver unit? Well, it's a compact unit, low in operating costs and high in versatility. You can install the unit on the extruder's take-up for efficient in-line operation, or set it up elsewhere in your plant where treatment is handled separately. The unit will process any gauge or width material, without altering finish or dimensions, without changing major characteristics.

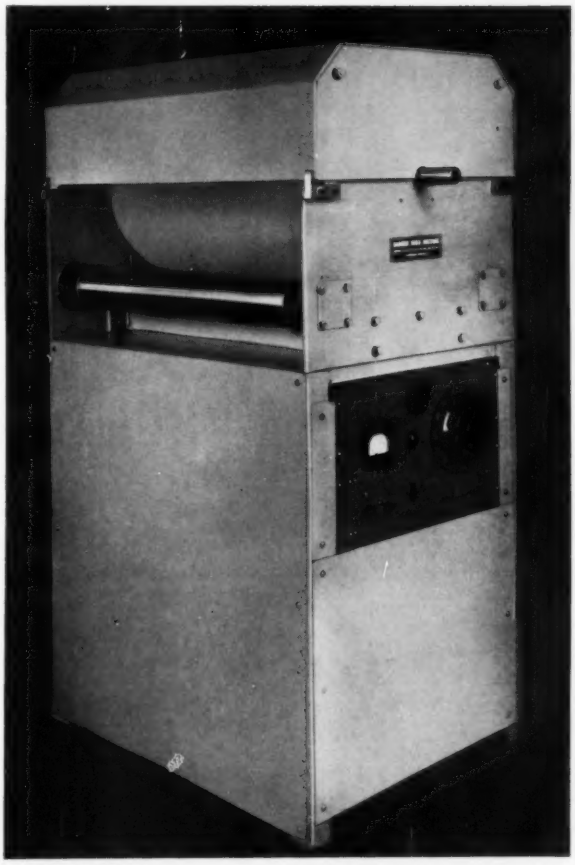
Electronic bombardment of material, as incorporated in the MPM-Traver unit, means processing without open flame, dangerous heat, or cooling problems. It means control of the treatment for uniformity of printing quality across the roll. The MPM-Traver unit is extremely safe to operate because it's interlocked for operator safety, and current automatically cuts off when threading film.



How does it work?

Material is fed either from a roll or directly from the extruder. As it passes through the unit, electronic bombardment occurs. This process is controllable by the operator to secure the degree of treatment desired. After treatment, the material is taken up on a roll where it is ready to accept printing at any subsequent time.

Modern Plastic Machinery Corp. holds exclusive manufacturing rights to this new development. For more detailed information, or to make arrangements for a demonstration, call or write today.



The MPM-Traver unit with safety guards removed

- Extruders
- Dryers
- Conveyors
- Granulators
- Special Equipment

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DRAW HIGHER PROFITS

by post-forming sheets of Plio-Tuf

Adding an end product of premium quality to the processing advantages of post-forming is a sure way of drawing higher profits from your investment. A sure way of achieving this greater return is by using sheets of PLIO-TUF.

PLIO-TUF is an internally reinforced, high styrene resin. It is available as uncompounded resin for calendering into sheets or as pre-formed, smooth or embossed sheets in a range of colors.

Laminated sheets of PLIO-TUF are readily post-formed on conventional equipment by any of the usual methods—vacuum draw molding, drape molding, ring and plug molding, blow molding or line bending. They can be deep drawn to a depth of nine inches or more without rupture. They form as well or better than other tough thermoplastic sheets.

Once formed, PLIO-TUF can be further fabricated or finished by any of a number of means. They can be drilled, punched, sawed, sewed, cemented, sanded, polished, painted or plated by the usual methods.

But more important are the physical properties of post-formed PLIO-TUF. Over and above the usual properties of thermoplastic resins, PLIO-TUF exhibits outstanding resistance to impact, unusual resistance to distortion by heat and above-average stiffness (see opposite page). Abrasion-, chemical-, electrical-, age-, and weather-resistance are also excellent.

Details and samples of PLIO-TUF resin or a list of suppliers of PLIO-TUF sheets are yours by writing to:
Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL
GOODYEAR
DIVISION

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"We think highly of our SEVEN NRM Thermoplastic EXTRUDERS"

says John H. Schroeder, President of CRESCENT PLASTICS, Inc.

"We founded our business in 1949 with one extruder, an NRM. Its high production of top quality extrusions, at low cost for maintenance, naturally led to more NRM s as our business grew. With but one exception, all our extruders are NRM s and we believe them to be the most efficient machines on the market."

Apart from the fine materials and rugged construction which are basic NRM Characteristics, we're sure that such advanced operating features as 20:1 Le/D ratio, patented screw designs, balanced heat control and quick-opening die gates are some of the advantages which led Crescent Plastics officials to *standardize* on NRM Extruders . . . yet they're only a few of the many reasons why it will pay *you* to make your next extruder an NRM. Send today for full information on NRM Plastic Extruders and Equipment . . . it's the only *complete* line. Write today, there's no obligation.

Illustrations: NRM Model 50 3½" Electrically Heated Thermoplastic Extruder.

Partial view of extruding operations at Crescent Plastics, Inc.

2378

NATIONAL RUBBER MACHINERY COMPANY

NRM

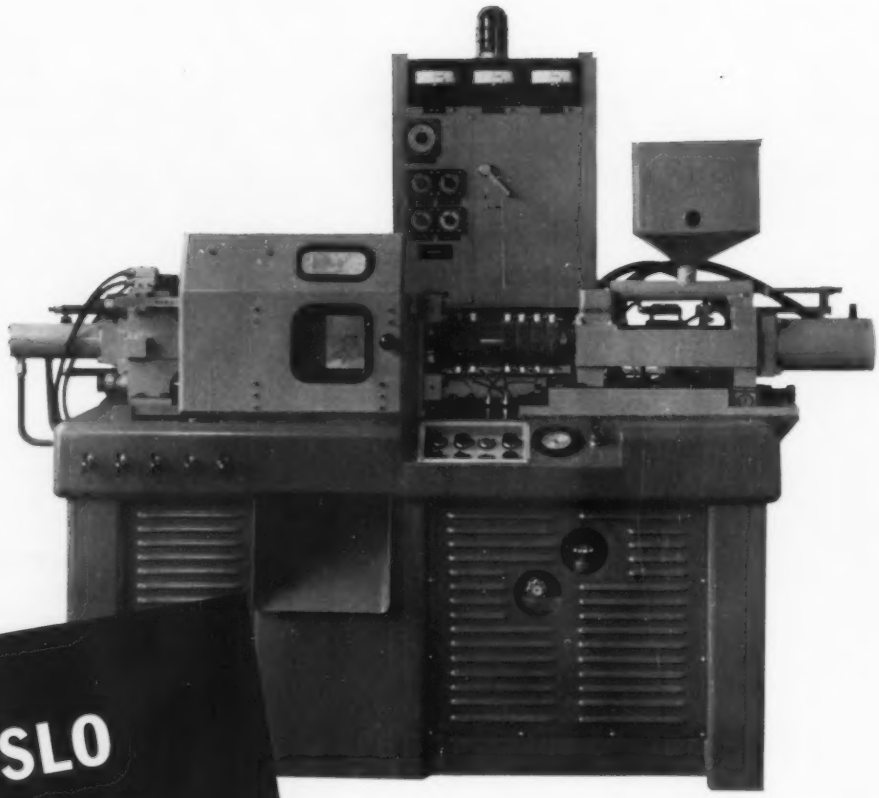
Creative Engineering

General Offices and Engineering Laboratories, 47 West Exchange St., Akron 8, Ohio

East: 384 Getty Ave., Clifton, N. J.

West: S. M. Kipp, Box 441, Pasadena 18, Cal.

Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.



MOSLO

presents a new SUPER 2-OUNCE PLASTIC MOLDING MACHINE

Moslo stays in front with a hydraulic plastic molding machine *that has everything.* Known as the 74, it is similar in design, but twice the weight and strength of the former Model 73. This new model is the *fastest* and *heaviest* small machine on the market. Designed to handle the tough jobs, the Model 74 is a really super deluxe, 2 ounce machine.

Check these outstanding features and see why the Moslo 74 is your best bet.

1. AUTOMATIC LUBRICATION of entire clamp mechanism.
2. HYDRAULIC INJECTION BOOSTER arrangement supplies full pressure for entire injection stroke.
3. HIGH SPEED PRODUCTION—plasticizing capacity of 50 pounds per hour.
4. FAST OPERATION—1250 cycles per hour (dry run).
5. HEAVY DUTY—Welded steel base and heavy gauge materials provide for sturdy and rugged construction.
6. HYDRAULIC MANIFOLD eliminates 60% of fittings and simplifies maintenance.
7. AUTOMATIC CONTROLS and SAFETY DEVICES assure maximum protection to operator, material, and machine.
8. MOLD SIZE—9" x 12".
9. MOLD CLAMP—75 tons.
10. PLUS FEATURES—incorporated in every Moslo machine are many exclusive features that have been developed from years of experience in the molding machinery business.

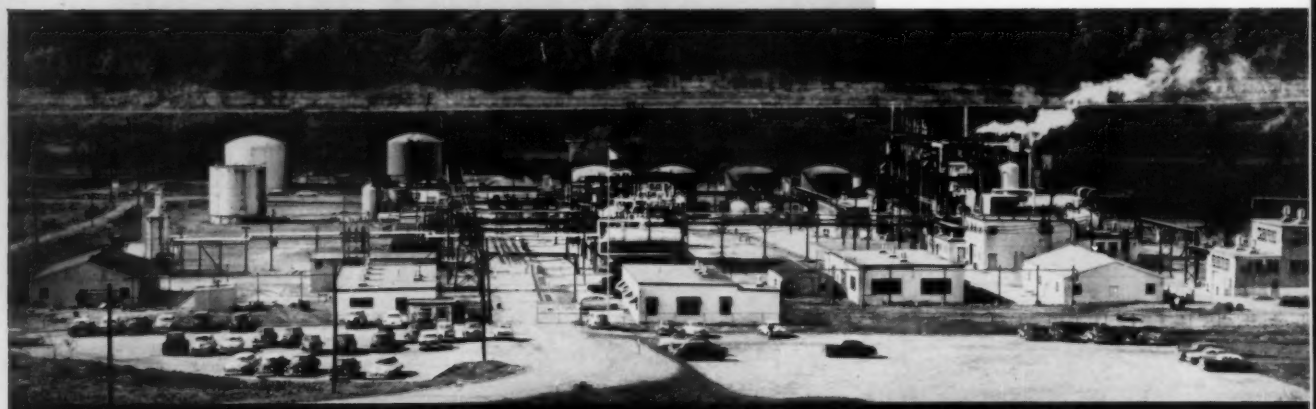
In addition to Model 74, Moslo also has available a sturdier Model 73 2 ounce machine. This model is a standard version of the Model 74 with fewer deluxe features and smaller plasticizing capacity.

Investigate Moslo before you buy any plastic molding machine.
We invite your inquiry and will be glad to send you additional information.

MOSLO MACHINERY COMPANY

2443 PROSPECT AVENUE • CLEVELAND 15, OHIO

Here's Where The World's Purest
FUMARIC ACID
Comes From...



MOUNDSVILLE, WEST VIRGINIA

$$HCCOOH$$
$$\|$$
$$HOOCCH$$

White, free-flowing crystalline powder

Strength, min.	99.5%
Ash, max.	0.1%
Maleic Acid, max.	0.1%

The only production direct from the catalytic oxidation of benzene, National Fumaric Acid is the highest-purity tonnage production ever achieved. Pure white, its absence of color commends it for use in resins, plasticizers and pharmaceuticals.

Our output is as dependable as its quality is high. We give exceptional service to all important consuming centers from plant stocks at both Moundsville, West Virginia and Buffalo, New York.

We will be pleased to quote and to send samples for work that may lead to new uses of National Fumaric Acid. The coupon at the right is for your convenience.

please send sample
of National Fumaric Acid to:

NAME_____

COMPANY_____

ADDRESS_____

_____

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

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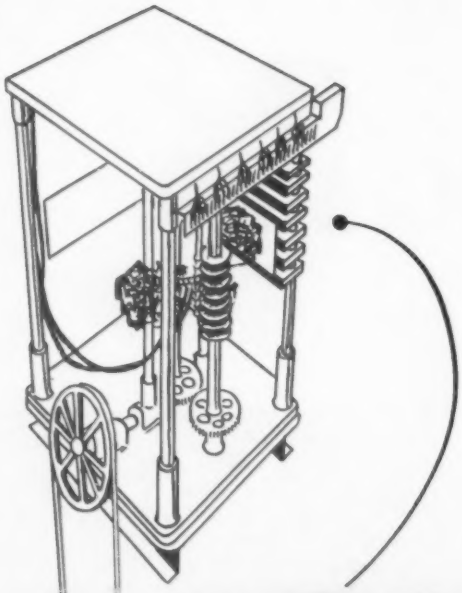
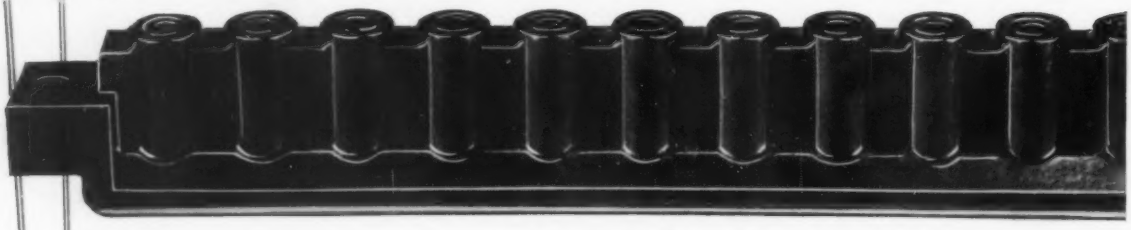
Portland, Ore. Greensboro Charlotte Richmond Atlanta
Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto



A Company you can trust ...trusts Norton



• The company is Otis, manufacturer of that safe, dependable transportation device, the elevator.

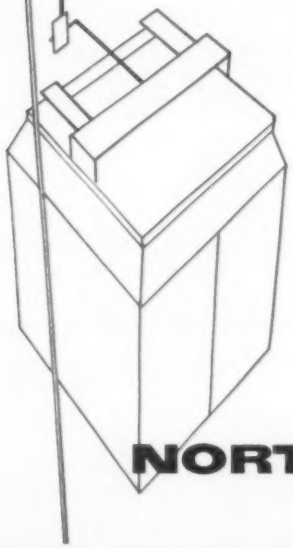
In 1932, Otis Elevator Company developed the Selector, a precision "brain" that regulates the operation of high-speed elevators. One component of the Selector is the Norton-produced floor bar, shown above. Wired with a complex network of electrical contacts, the floor bar "remembers" to stop the car smoothly and levelly at selected floors, open the doors, control signals, and perform many other functions.

Norton has molded this durable Otis component for 23 straight years.

That is a record we're proud of for a couple of reasons. First, because it gives strong support to our claim that top manufacturers "let Norton do it." And it shows that Norton's superior skill in molding plastics is consistent and of long duration. We've been custom molders for 25 years, to be exact.

Remember this case history the next time you're developing a new product or improving an existing one—and call Norton. Our technical representative will tell you if your product should be made of plastic . . . if so, what the best molding method will be . . . how much it will cost. Only after all this service will he explain why you should "let Norton do it."

Sound good? Call us today.



NORTON *Laboratories, Inc.*

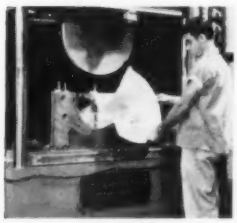
COMPRESSION AND INJECTION MOLDING

Best for REINFORCED PLASTICS

Stock-Line H-P-Ms are Designed For The Job!

From flat sheet stock to deep draw washing machine tubs, an H-P-M is built for the job! With plenty of daylight and stroke, each press is equipped for semi-automatic operation, fast closing, automatic slow-downs and accurate control of speed and pressures necessary in the molding of reinforced plastic parts.

Air Conditioning



Aircraft

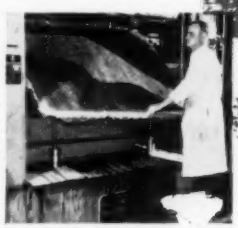
Yes, H-P-M presses have made a name for themselves in the reinforced plastic industry. Shown pictorially are a few industries using reinforced plastics moldings and H-P-M presses. And, there are a multitude of new markets opening up for the molder who is equipped to mold reinforced plastics on a production basis.

Write today for complete data on this line of *stock presses and take advantage of the growing market with H-P-M Presses.

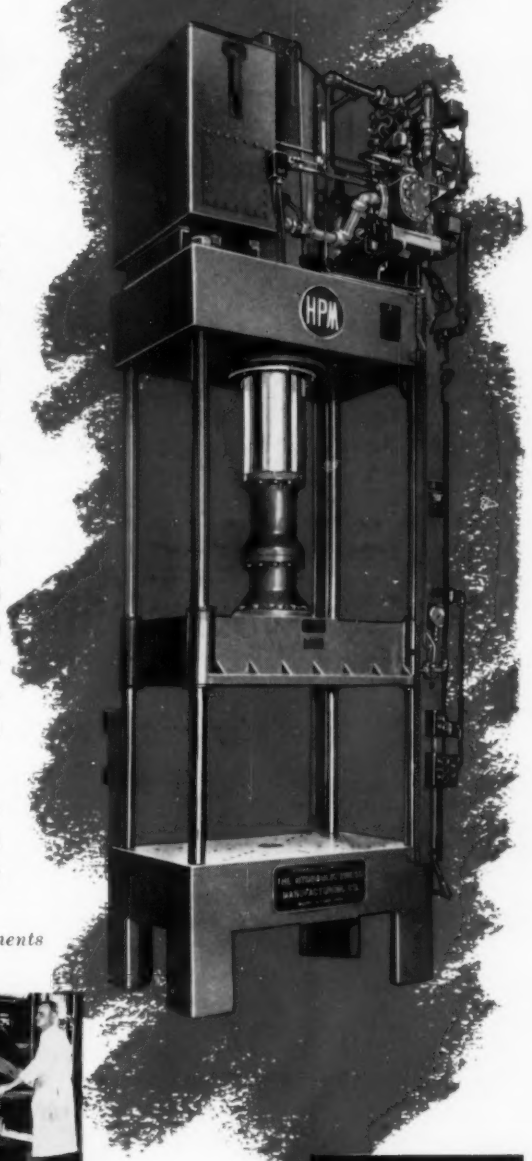
**Larger sizes built to customers' requirements*

Office Fixtures

Appliances



Furniture



THE HYDRAULIC PRESS MFG. COMPANY

1010 MARION ROAD, MOUNT GILEAD, OHIO, U. S. A.

HPM

does cold weather do strange things to your plastics?

then give your product low-temperature flexibility with Plastolein® 9058 DOZ!

If plastic products made from your film, sheeting or extrusions become stiff and wrinkled in cold weather, you may be freezing up a lot of reorders. Then getting better low temperature flexibility is the answer. And no plasticizer can provide this better than Plastolein 9058 DOZ (di-2-ethylhexyl azelate) or its companion, Plastolein 9057 DIOZ (di-iso-octyl azelate).

Not only do these azelate plasticizers provide unexcelled low-temperature performance, but they also possess low volatility, excellent heat and light stability, high efficiency, low water extraction, and extremely low soapy water extraction...all of which make these Plastolein Azelates the best all around low-temperature plasticizers available.

So, why not try Plastoleins 9058 DOZ or 9057 DIOZ in your product. The competitive advantages they give will mean greater consumer acceptance... greater sales to you. Write Dept. F-7 for literature or samples.

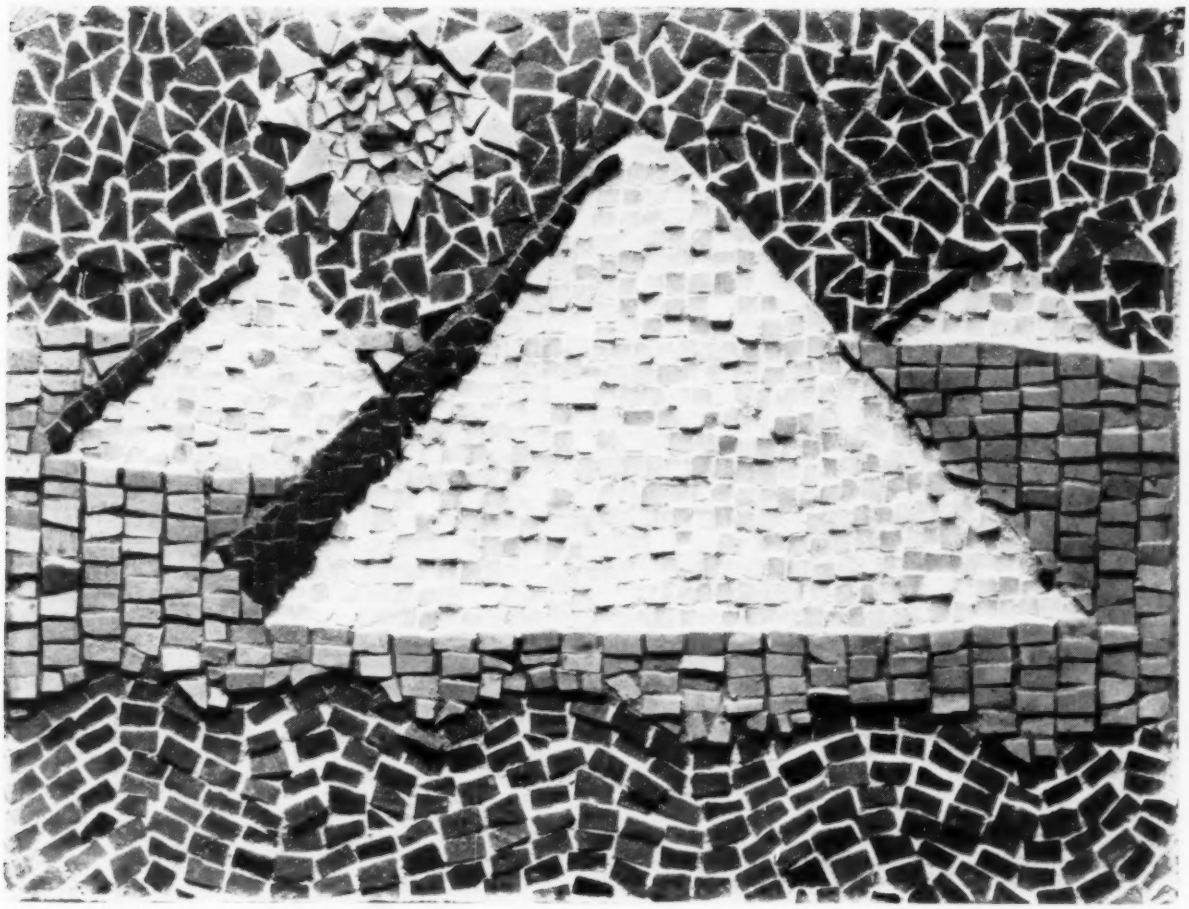
Be sure your plastics stay plastic . . . use Plastolein Plasticizers every time

Emery

Fatty Acids & Derivatives
Plastolein Plasticizers
Twitchell Oils, Emulsifiers

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

New York; Philadelphia; Lowell, Mass.; Chicago; San Francisco; Cleveland
Warehouse stocks also in St. Louis, Buffalo, Baltimore and Los Angeles • ***Export:** 2205 Carew Tower, Cincinnati 2, Ohio*



Reproduction of Mosaic specially created for this series by artist Fran Fink.

Fifth in this series of the Seven Wonders of the ancient world are the great pyramids of Egypt. In historical sequence they are actually first for they were built more than 3,000 years before the birth of Christ. The largest of the three, King Kheops pyramid, took 100,000 slaves twenty years to build. Everyday of the twenty years they pulled, pushed, and strained 300 blocks, each weighing 5,000 pounds, up steep inclines. There they were laid in place by stone masons at the incredible rate of one block every 2½ minutes. Although intended for the remains of King Kheops, his bereaved family, afraid of thieves, buried him elsewhere.

NO REJECTS HERE!

And you'll get no rejects when you lubricate your molds with Metasap® Zinc or Calcium Stearates. Your finished products pop out of the mold quickly, easily, smoothly.

You can verify this with most any experienced molder.

You can add these Stearates in either of two ways. Incorporate them in the molding compound...or simply dust them onto the mold surface.

Either way, you'll find this improved lubrication *minimizes ejection pressures,* increases your output, improves your product. Your molds last longer, too.

So specify compounds containing Metasap Stearates, or incorporate them directly into your own molding compound. Metasap Technical Service is ready to help you find the materials and mixing procedures best fitted to your production methods.

EXCELLENT THICKENERS FOR PLASTISOLS

Metasap also offers a complete line of quality Stearates, effective as thickening agents. We'll be glad to make available to you free testing samples of Magnesium, Barium, Calcium, or Aluminum Stearates. Ask for yours today.

METASAP CHEMICAL COMPANY
HARRISON, NEW JERSEY

METASAP CHEMICAL COMPANY

Chicago, Ill. • Boston, Mass.
Cedartown, Ga. • Richmond, Calif.
London, Ont. Canada

A NOPCO Subsidiary

the cleanest stearates made

You can simplify purchasing . . . improve design . . . speed production

with improved C-D-F DILECTO® laminates

Only C-D-F, the Continental-Diamond Fibre Company, makes Dilecto laminated plastic, just as only Cadillac makes a Cadillac. Dilecto is 50 different materials with more combinations and variations in desired properties than we can tell you here.

But Dilecto has three important qualities that you should think about if you buy, design, or machine laminated plastics.

DILECTO HAS HIGH MECHANICAL STRENGTH

Mechanical strength is frequently an important determining factor in the selection of an insulating material. Insulating parts used in large electrical power equipment are frequently bulky. The high mechanical strength of Dilecto helps reduce size-dimensions of insulating parts without danger of failure. Instruments, meters and small motors frequently require very small insulating parts which must withstand comparatively large mechanical stresses. Insulation for use in high frequency circuits should have a minimum bulk factor for minimum dielectric losses. Dilecto fulfills these requirements with a combination of high mechanical strength and low loss factor, characteristic of the better C-D-F electrical grades.

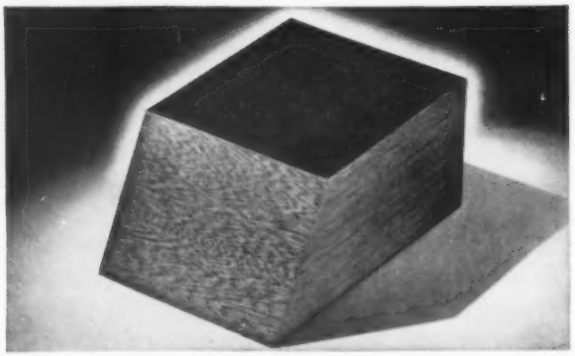
So C-D-F selects for your Dilecto insulation grade the correct, highest quality base material, paper, cotton, nylon, glass. These are used in combination with improved penetrating resins: Improved Phenolic, New Melamine, New Silicone, New Teflon, all synthetic, well polymerized resins.

Both the base and the resin are good insulators by themselves. But C-D-F sells them to you in an improved, practical form . . . Dilecto. Uniform sheets, tight tubes, strong rods, close tolerance machined and formed specialties, high bond strength metal clads.

Why does Dilecto combine so well mechanical strength with dielectric strength and dimensional stability? Because Dilecto is almost homogeneous, a true blend of resin and base.

DILECTO IS ALMOST HOMOGENEOUS

A poor laminate absorbs moisture at its edges, loses its insulating properties fast. Entrapped moisture and other volatiles within the cured structure causes inconsistent dielectric strength, with ultimate puncture and breakdown.



Punch press and bench saw operators know how much time and material is saved when the laminated plastic is *uniform* and *homogeneous* in nature like Dilecto.

DILECTO IS IMPROVED

Yes, C-D-F Dilecto is an improved laminated plastic, due to high standards and advances in resin and manufacturing techniques. It is watched by skilled workers in our modern plants, checked against rigid standards . . . C-D-F standards . . . by our quality control people. It is easy to machine, and the C-D-F shops are doing a booming business in specialties.

Table I—Typical Improved Phenolic Laminates

Commercial designation[a]	Resin	Filler	Improved properties	Improvement due to:
MEC-5	Phenolic	Nylon fabric	Insulation resistance; moisture resistance	Filler
XXHV-2[b]	Phenolic	Paper	High dielectric strength parallel to laminations	Resin and manufacturing technique
CRD	Phenolic	Cotton mat	Better machining	Filler
XXXP-26[b]	Phenolic	Paper	Insulation resistance; moisture resistance	Resin and manufacturing technique
C-92	Xylenol[c]	Cotton fabric	Alkali resistance	Resin
CF	Modified phenolic	Cotton fabric	Postforming	Resin

[a] All grades are Continental-Diamond Fibre Company.
[b] Resins have improved penetrating properties and the manufacturing techniques use these properties to provide better impregnation of the filler. Since thorough impregnation eliminates entrapped moisture and air, greater moisture resistance and better dielectric properties are attained. Manufacturing techniques also provide suitable temperature control during the curing stage to assure uniform quality and optimum property values in the finished laminate.
[c] Xylenol is essentially a dimethyl phenol.

—from Electrical Manufacturing Article "Wider Design Opportunities with the NEW Phenolics", Part II.

The next time you think of laminated plastics, the name to remember is C-D-F Dilecto. The improved, high strength, uniform material that makes insulation buying and using more a science, less a puzzle. New grades, new applications, new savings are just part of the Dilecto success story. Look up the facts in Sweet's Design File, or write for catalog. Send us your blueprint for quotation . . . tell us your design dream . . . C-D-F wants to work with you.

CDF *Continental-Diamond Fibre*

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK 28, DELAWARE

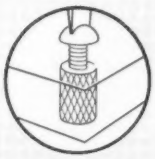
Well planned is ONLY *half done . . .*

make plans pay off with P-K

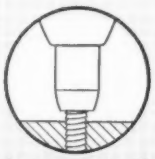
ASSEMBLY COSTS GO DOWN

Save cost of tapping and tap equipment

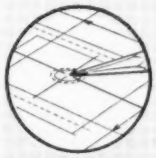
Save cost of "two-side" fastening



Save cost of inserts for machine screws in plastics



Permit extra speed of power and automatic driving



Permit simpler design — fewer fastenings

ASSEMBLY COSTS STAY DOWN WITH

For almost any assembly, you can plan cost-reduction from savings like these and many other advantages of Self-tapping Screws. But the promise of savings can fade in production if screw failure snarls up the line.

That's why quality standards for P-K Self-tapping Screws were set so high to begin with, and are still harder to match today.

Only Parker-Kalon can offer P-K experience —covering many more years and millions more applications than any comparable record.

Only Parker-Kalon can offer P-K quality, the indispensable extra, along with the proved advantages of Self-tapping Screws.

Plan your assemblies for lowest cost . . . a P-K Assembly Engineer will help you. Then purchase to *keep* cost down . . . order "P-K". Parker-Kalon Division, General American Transportation Corporation, 200 Varick Street, New York 14.

IN STOCK See your P-K DISTRIBUTOR

Screw faults are hard to see, but cost sheets and customer complaints soon show their effects — job slowdown, parts damage, high reclamation costs, loosening under vibration, hidden weakness.

P-K QUALITY STANDARDS PROTECT YOU against defective screws . . . *all* the P-K Screws you get are *Guaranteed First Quality.*

FRED H. SCHELL
Pacific Coast Representative

PACIFIC COAST OFFICE
147 San Vicente Blvd.
Beverly Hills, California
Telephone: WEbster 5-0269

PARKER-KALON®

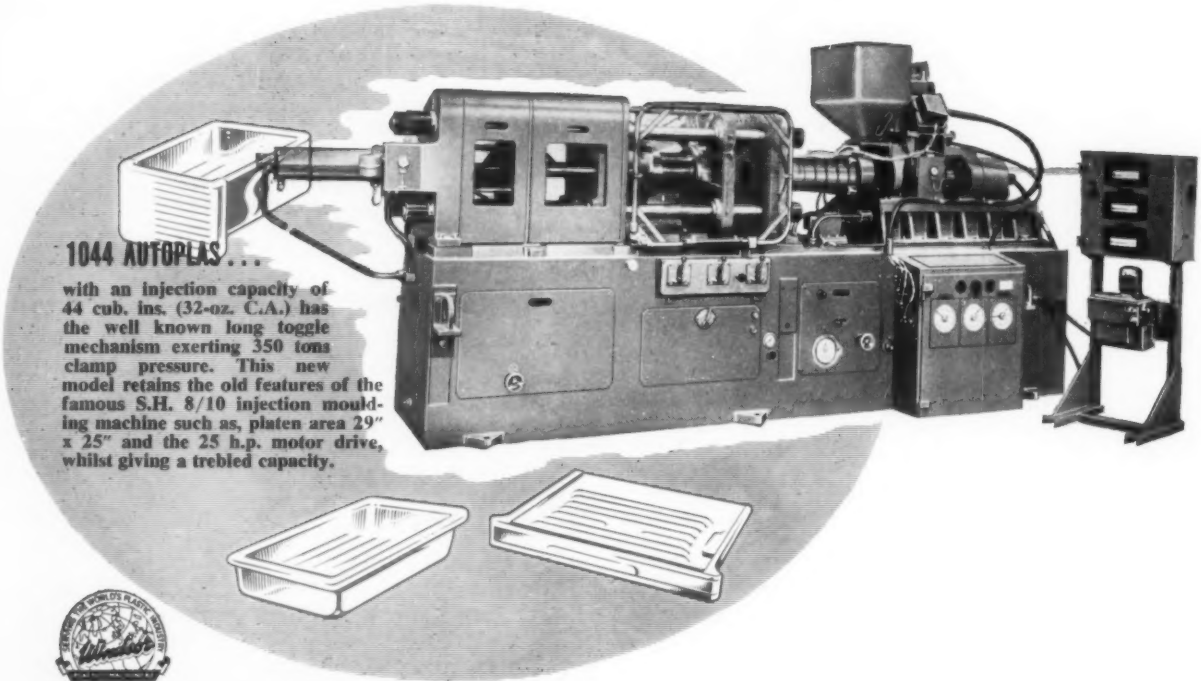
The First **SELF-TAPPING SCREWS**

Remember **P-K** means **OK**

QUALITY EXTRUSIONS

The R.C.100 twin-screw machine is a medium capacity extruder with a nominal output of 100 lb. per hour and will operate continuously over long periods, producing tubes, rods and sections in thermoplastic materials. Coated cables, rods and tubes are standard jobs.

INJECTION MOULDING



1044 AUTOPLAS . . .

with an injection capacity of 44 cub. ins. (32-oz. C.A.) has the well known long toggle mechanism exerting 350 tons clamp pressure. This new model retains the old features of the famous S.H. 8/10 injection moulding machine such as, platen area 29" x 25" and the 25 h.p. motor drive, whilst giving a trebled capacity.

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CANADA WILMOD CO., PLASTIC DIVISION, 2488 DUFFERIN STREET, TORONTO

Introducing...

Troytuf

DACRON BLANKET

A new and superior reinforcing material for polyester and epoxy resins

We invite you to write for samples of Troytuf Dacron Blanket for conducting your own tests

● Troytuf Dacron* Blanket for reinforced plastics molding is an extra-strong, light weight reinforcing material, ideally suited to molding with epoxy and polyester resins. It differs from most other reinforcing media in that the fibres are tightly interlocked into easily-handled blanket form by a unique needle punching operation. Troytuf has excellent deep drawing, dielectric and machining qualities which open many new, potentially high volume, product applications.

STRENGTH—The majority of Troytuf's advantages stem from the fact it consists of pure Dacron fibres, bound together mechanically without any binder or adhesive. The material has balanced orientation, its strength being equal in all directions. Troytuf moldings exhibit good dimensional stability and are not brittle. Also, Taber Abrader tests show Troytuf laminate has a high abrasion resistance.

WEIGHT & DENSITY—Troytuf Dacron Blanket is 20% lighter than fibrous glass, yielding products with unusually favorable weight/strength characteristics. For example, four layers of 10 oz. blanket, each 3/8" in thickness, reduce down to 1/8" at 85 psi. The blankets can be supplied in any specified widths to 120".

SURFACE—Troytuf moldings are distinguished by superior surface appearance. The fine, uniform Dacron fibres are almost completely masked by the resins which are used. Individual fibres are not apparent, except on closest inspection. The fibres are white and blend nicely with resins of any color.

IMPREGNATION—The absence of a chemical binder eliminates any need for preforming. Troytuf can be loaded with extremely high resin concentrations. It is suitable for pre-impregnation with 2-stage resins.

FABRICATION—Moldings made with Troytuf machine easily and have good punching quality. Retention of inserts and screws for assembly purposes is excellent. Molded stock is post-formable.

APPLICATIONS—Troytuf Dacron Blanket is particularly suited for molding deep-draw pieces since it readily conforms to complicated shapes without requiring special tailoring. Outstanding dielectric and electronic transmission properties recommend it for printed circuitry, radomes and the like. Troytuf's good resistance to the corrosive effects of mineral acids make it especially appropriate in products subjected to such deleterious chemical action. Its light weight, high strength and good appearance are of importance in many general reinforced plastics applications.

SAMPLES—Troy Blanket Mills will, without obligation, supply full details and samples of Troytuf Dacron Blanket for experimental molding. *Troy Blanket Mills, 200 Madison Avenue, New York 16, N. Y.*

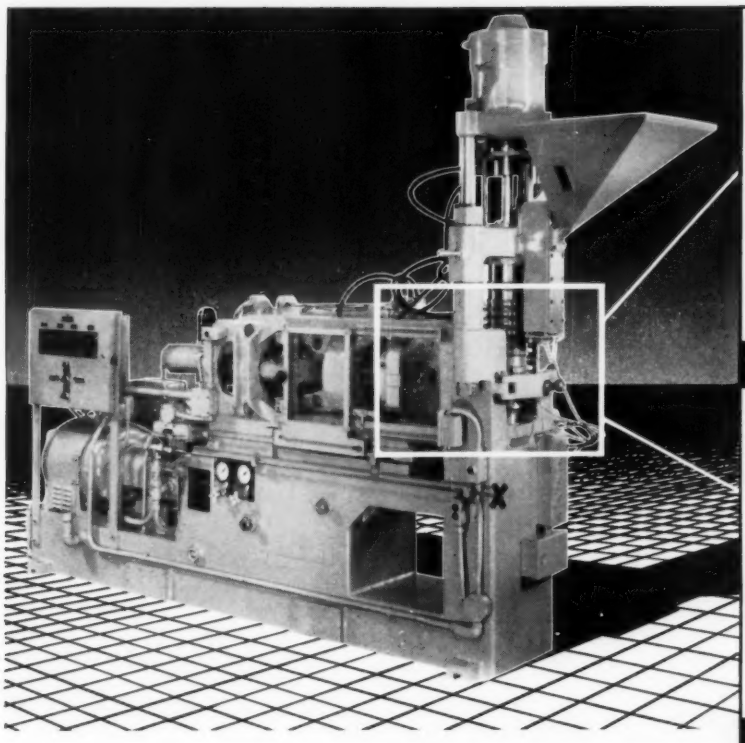
REINFORCING

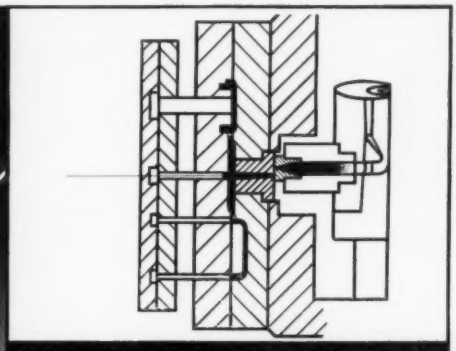
Troytuf

BLANKETS

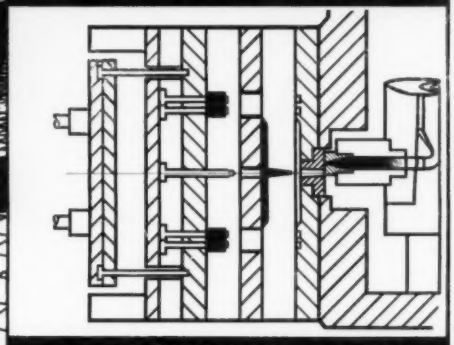
*DuPont trademark

Exclusive CUT-OFF ATTACHMENT means Foolproof LESTER-AUTOMATIC MOLDING





SPRUE SHEARING ON TUNNEL GATED MOLD



SPRUE SHEARING ON 3-PLATE MOLD

The big plus feature of the L-1/2-4 oz. LESTER-AUTOMATIC is the sprue shearing attachment. It cuts the sprue and string *before* the mold opens. Every other machine wastes valuable cycle time by shearing after the mold opens. The cut-off attachment allows the greatest range of mold design, including sprueless hot runner, tunnel gated or 3-plate molds.

Other features that make the L-1/2-4 oz. Lester superb for automatic molding are:

1. Positive pneumatic mold wiping (optional). Rigidly mounted to the solid steel frame, insuring minimum lost time for mold clearing and minimum part loss from scattering.

2. Automatic recycling with adjustable time delay for mold clearing.

3. Fail-safe low pressure mold closing circuit which combines full-speed mold closing with low clamping pressure until the die faces meet.

This self-contained machine is in operation, individually or in batteries, tended by only one operator. Our technically trained sales representatives will be happy to give you the details on these and other exclusive Lester features for automatic molding.

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York . . . . Steven F. Krould
Detroit . . . . . M. R. Tenenbaum
Chicago . . . . . J. J. Schmidt
Cleveland . . . . . Don Williams
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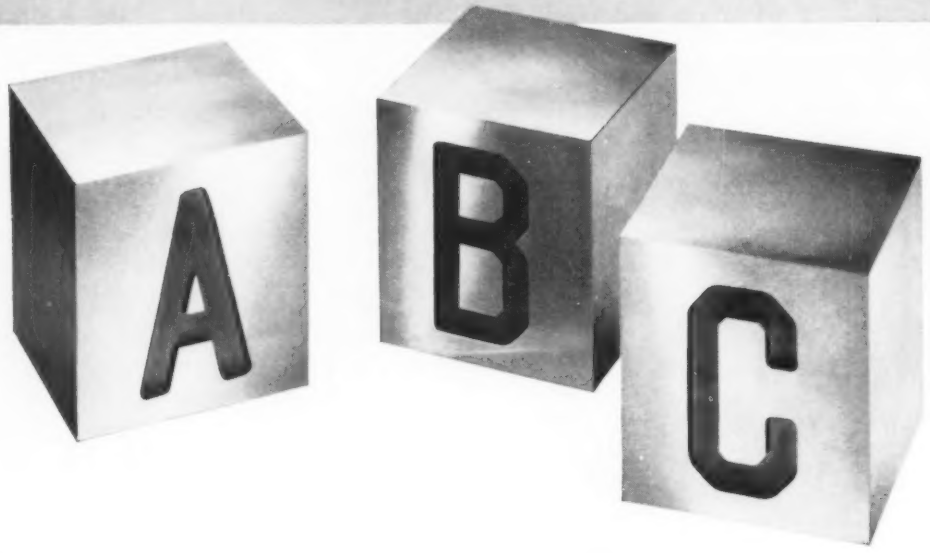
DURAMOLD



Know these ABC's for Cold-Hobbing?

To be sure of economy when cold-hobbing plastic dies, you will find it useful to know the ABC's of Bethlehem's Duramold tool steel grades. These three hobbing steels have every requisite for good performance in cold-hobbing. They are clean, free from surface and internal defects, and are capable of producing dies which take a mirror-like polish.

DURAMOLD A (air-hardening). Has high core-strength (RC-30). Annealed to a softness of 109 max Brinell. Easy to hob. After carburizing, the surface can be polished to a high lustre.

DURAMOLD B (oil-hardening). Has excellent combination of high core-strength (RC-15), and ease of hobability. Annealed to under 100 Brinell. Has an addition of boron, which effectively increases the core strength, with no detriment to hobbing.

DURAMOLD C (water-hardening). This low-carbon steel is easiest to hob, as it is annealed to 90 max Brinell. After carburizing, it can develop a case hardness of RC-62.

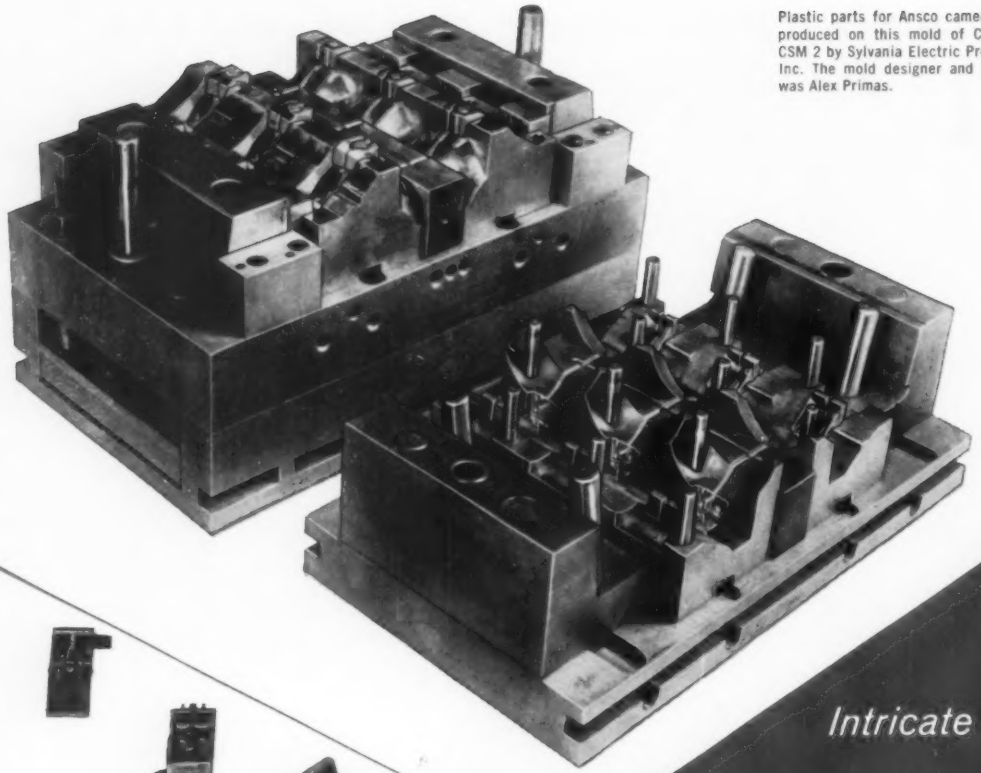
In addition to tool steels for cold-hobbing, Bethlehem produces a full line of machined-cavity and master-hob steels. For full information, just get in touch with your Bethlehem tool-steel distributor, or call the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEELS

BETHLEHEM STEEL



Plastic parts for Ansco cameras are produced on this mold of Crucible CSM 2 by Sylvania Electric Products, Inc. The mold designer and builder was Alex Primas.

Intricate mold of

CRUCIBLE CSM 2

forms Ansco camera parts

This intricate six-cavity mold of Crucible CSM 2 mold steel produces small plastic parts for the flash holder of an Ansco camera.

It's an exacting molding operation, for the parts must be perfectly uniform and interchangeable. Success of the job depended upon a combination of excellent mold and part design, skilful mold building and mold operation and mold steel of the highest quality. That's why Crucible CSM 2 tool steel was chosen.

Whether your application requires a mold as complex as this one, or one of several tons, you can rely on Crucible. For Crucible mold steels are actually tool steels . . . produced in the country's foremost tool steel mill. So check with your Crucible representative. He can tell you how Crucible CSM 2 fits your job, and see that it's shipped *fast* from local stocks.

CRUCIBLE first name in special purpose steels

54 *years of* Fine *steelmaking*

MOLD STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

Vivid color, better hand...when vinyl sheeting is "Dutch Boy" formulated.

How to team up "Dutch Boy" Plasticizers and Stabilizers to

Improve Quality and Cost Control in Vinyl Sheeting

Today, buyers want vinyl sheeting that is sturdier and more economical than ever before. It can't be stiff. It must have good drape and hug contours well.

Leading vinyl sheeting makers meet these demands with the following "Dutch Boy" Plasticizer-Stabilizer combination.

For the plasticizer portion...

"Dutch Boy" Plasticizer NL F-31 is used for the biggest part of the plasticizer portion. It provides the outstanding flexibility, drape and hand needed for heavy gauge material. *"Dutch Boy" Plasticizer NL F-21* is added to give the low volatility that makes for long life.

The plasticizers are completely compatible and aid light stability and aging characteristics.

For the stabilizer portion...

"Dutch Boy" Clarite...more and more manufacturers agree . . . is a stabilizer you can depend on in sheeting systems. It gives excellent light and heat stabilization. It also provides the right degree of lubrication. What's more, *Clarite* is non-staining.

Another popular *"Dutch Boy" Stabilizer, Plumb-O-Sil® C* develops an excellent dry surface which accepts imprinting well. Because its refractive index is close to vinyl chloride's, colors are vivid, undimmed. *Plumb-O-Sil C* may be used alone or in combination with *Clarite*.

"Dutch Boy" Dyphos® 50-A is added when you want to build up outstanding weather resistance in outdoor products. It also insures long-lasting flexibility.

Look into the details this easy way

You can get typical formulation, incorporation suggestions, many other facts very easily. Just call on National Lead's technical staff.

Ask them to tell you about other successful "Dutch Boy" Plasticizer - Stabilizer combinations, too . . . for vinyl film, electrical insulations, profile extrusions, lots more. Or write for National Lead's 12-page condensed catalog, "Dutch Boy Chemicals."

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West • Montreal

Carried...Not Pulled!

There's never a strain on the web in multi-color Lembo "Flexographic" and Rotogravure Presses. The web is **carried** — not pulled — from impression cylinder to impression cylinder, assuring perfect **in-register** printing at speeds up to 500 feet per minute.

Critical plastic film printers appreciate the ease and speed on widths from 14" to 72".

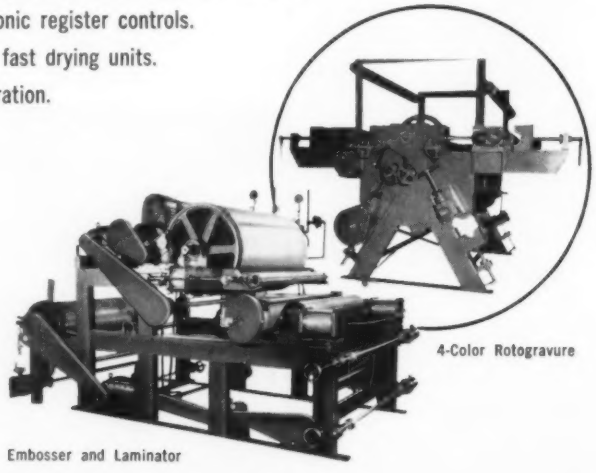
Choice of 360° planetary gear register or electronic register controls.

Equipped with unwinds, rewinds and fast drying units.

See the Lembo "Flexographic" and Rotogravure in operation.

Write for full particulars and quotations.

ROTOGRAVURE
LEMBO PRESS
FLEXOGRAPHIC



4-Color Rotogravure

Embosser and Laminator

LEMBO MACHINE WORKS, INC., 248 EAST 17th ST., PATERSON 4, N. J. • Mfrs. PRESSES · EMBOSSERS · LAMINATORS · ROLLERS

The "Electronic Look" that enlarges 21,000 times!

When you step up the size of a pigment sample 21,000 times, you get an accurate picture of its physical properties. That's why Glidden research technicians use a powerful electronic microscope for these examinations.

This is just one of the many control tests made frequently throughout the production process to insure constant pigment uniformity. It's this Controlled Quality that makes Glidden pigments the finest available anywhere—and, which assures your complete satisfaction with Glidden Rutile and Anatase Titanium, CADMOLITH Reds and Yellows, SUNOLITH Lithopones.

Write now for detailed information on these and other products of Glidden Planned Research.

THE GLIDDEN COMPANY

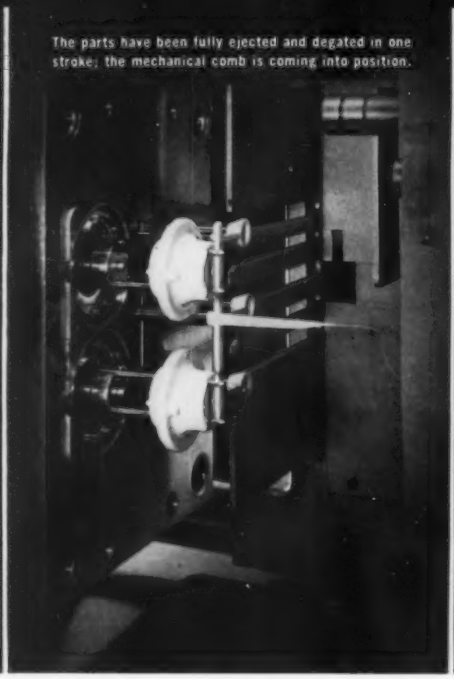
Chemicals • Pigments • Metals Division

Baltimore, Maryland • Collinsville, Illinois • Hammond, Indiana • Scranton, Pa.

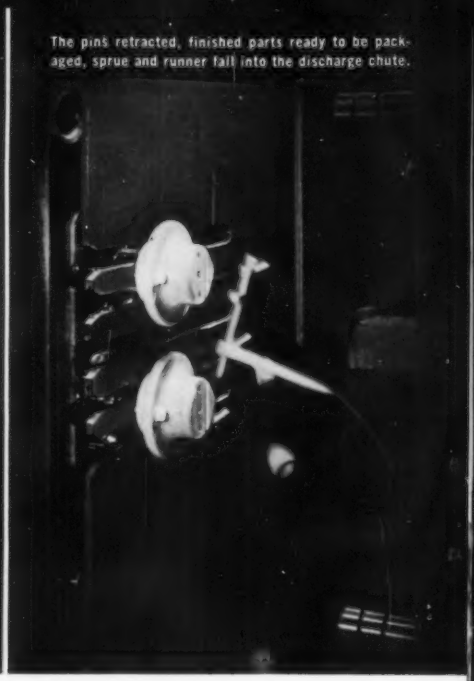
CHEMICALS
PIGMENTS
METALS

QUALITY
Glidden
PRODUCTS

The press is fully open, showing a 5-cavity mold used to produce two different parts from an assembly.



The parts have been fully ejected and degated in one stroke; the mechanical comb is coming into position.



The pins retracted, finished parts ready to be packaged, sprue and runner fall into the discharge chute.

THIS IS COST-CUTTING AT WORK...

STOKES truly automatic injection molding machine cuts costs for plastic molders

Truly automatic injection molding is helping molders to operate more profitably. The unique Stokes features of *automatic degating* and *positive ejection* produce finished parts, ready for packaging and shipment without further processing. They provide a degree of automatic operation unequalled in the field today.

The Stokes 4-ounce injection molding machine ends compromise between mold cost and labor charges. Mold cost can be kept low, fewer cavities used, cost per piece kept to a minimum because of low labor charges. For custom molders, the Stokes Model 700 provides the flexibility required in this competitive field.

The new Stokes machine is universally automatic . . . each type of part can be run with equal efficiency and economy. You should know more about the Stokes Truly Automatic Injection Molding Machine. Write for Bulletin 560 which contains full information. Ask also for an informative brochure, "Fully Automatic Molding".

F. J. Stokes Machine Company
Philadelphia 20, Pa.

This plastic part, used as a connector between wet mop and handle, could only have been made economically on a Stokes *truly* automatic injection molding machine.

Produced in small quantity by a custom molder, the part had to be competitive in price with the metal stamping it replaced. On a semi-automatic machine, labor cost per piece would be excessive because the small mold would limit production. If a large mold were used, mold cost per piece would be excessive because of the short run. On the Stokes 4-ounce injection molding machine, an inexpensive 4-cavity mold was used and automatic operation reduced labor cost per piece to a point at which the molder could secure the contract.

STOKES

Send for your sample and see...

how as little as 3% Magnesol*

mixed with phenolic molding powder

- **Promotes Cure**
- **Reduces Blistering and Pimpling**
- **Improves Dimensional Stability During Cooling Interval**
- **Facilitates Mold Release**

MAGNESOL adds much in many ways yet costs less than the molding powder its volume replaces.

Being a highly-absorptive, non-reactive, inorganic powder, MAGNESOL is an exceellent flow promoter. Its finely divided structure imparts a "slippy" coating to particles of phenolic molding powder makes it easier to handle. In the mold, MAGNESOL adsorbs gases, moisture, and other impurities that cause blistering and retard cure.

MAGNESOL is well worth trying in your plant. Use the handy coupon at right to send for Technical data sheet S-100 and your working-sample.

fmc Westvaco CHEMICALS

Please send Technical Data sheet S-100 and a working sample of MAGNESOL to:

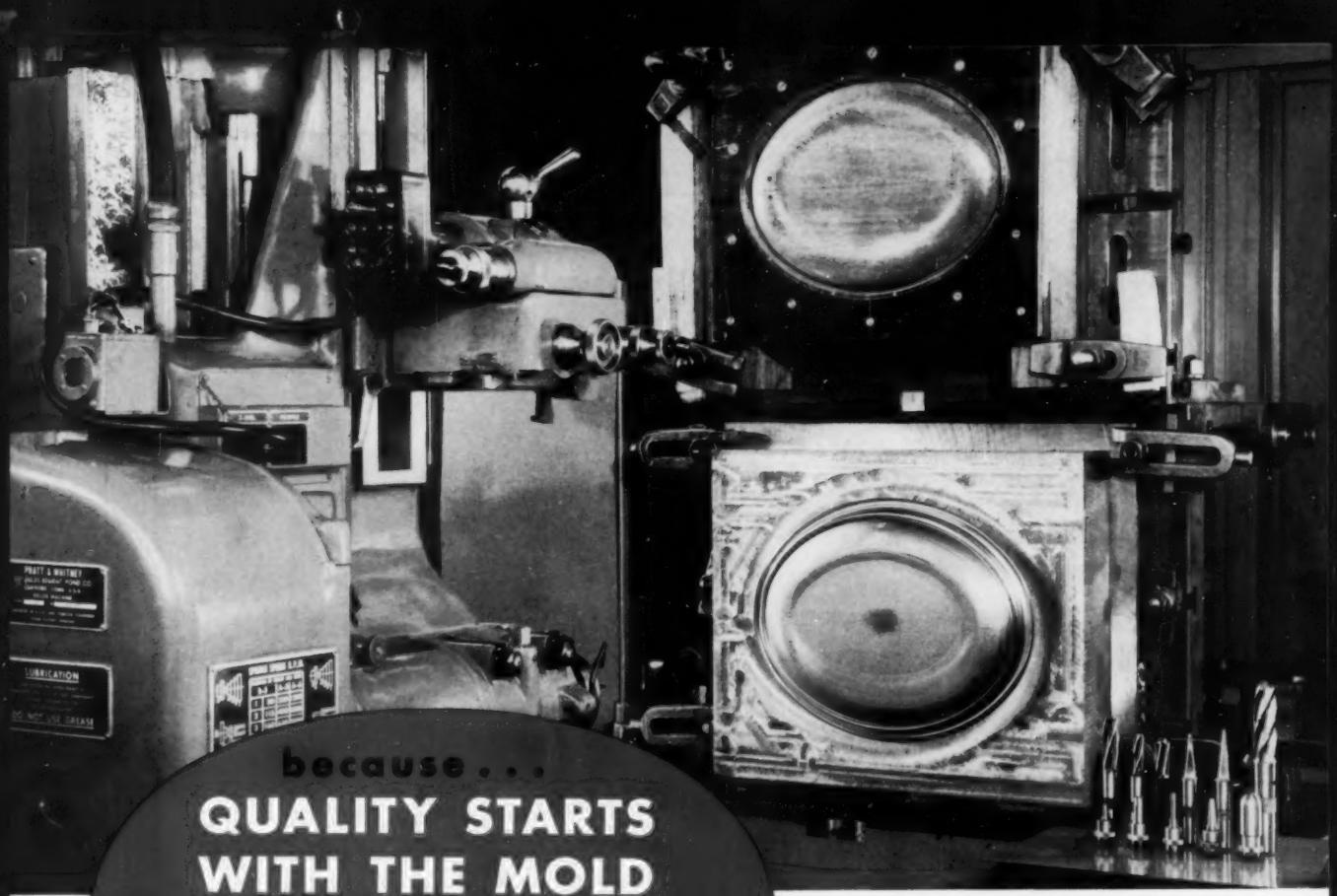
NAME_____

ADDRESS_____

CITY_____

Westvaco Chlor-Alkali Division
FOOD MACHINERY AND CHEMICAL CORPORATION
General Offices • 161 East 42nd Street, New York 17
CHARLOTTE, N.C. • CHICAGO, ILL. • DENVER, COLO. • PHILADELPHIA, PA. • ST. LOUIS, MO.

*MAGNESOL is the registered trade mark of Food Machinery and Chemical Corporation for its brand of magnesium silicate adsorptive powder, made by patented processes.



because . . .

QUALITY STARTS WITH THE MOLD

. . . better start with

PRATT & WHITNEY "KELLERING"

PRODUCE *ALL* YOUR MOLDS . . .
simple or intricate, small or large, original or duplicate, single or multiple cavity.

FASTER, BETTER AT LOWER COST

ON A P&W KELLER MACHINE . . .
rugged, dependable, relatively simple. Built specifically for automatic, tracer-controlled milling. Takes on your toughest jobs without requiring major alteration. Duplicates any 3-dimensional shape quickly, accurately, automatically.

The complete line of P&W Keller Machines includes models for a very wide range of work sizes . . . there's a machine just right to handle *your* molds better. Write now on your Company letterhead for complete information. Ask for your free copy of Circular No. 490-3 describing the Type BL (for small and medium size molds), or Circular No. 565-1 describing the Type BG-21 (for larger molds).

THE MACHINE TOOL SHOW CHICAGO, ILL.

See the P&W Keller Machines in operation at Space 1219.

MODERNIZE with PRATT & WHITNEY REPLACE FOR PROFIT

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BRANCH OFFICES . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI
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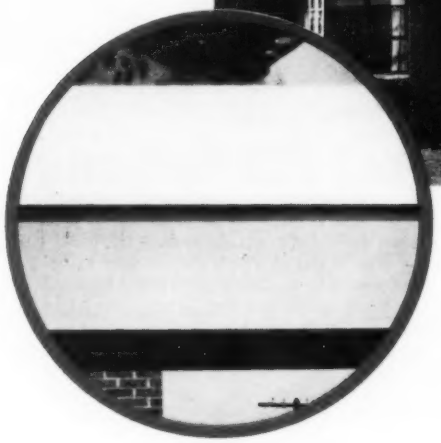
FIRST CHOICE FOR ACCURACY SINCE 1860

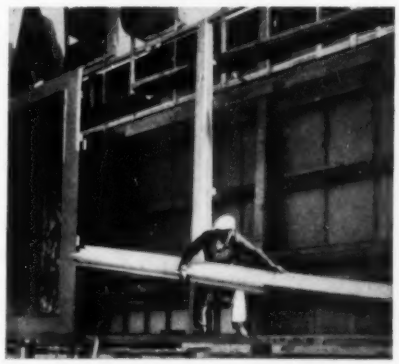
MACHINE TOOLS • CUTTING TOOLS • GAGES

BILLBOARD at Jackson and McKibben Streets, Lima, Ohio, is close to a chemical plant and a rubber factory, and within a block and a half of two railroads. Erected a year ago, it's unharmed by smoke and industrial fumes, has been continually free of maintenance.



Trim produced by **Kimball Mfg. Corp.**, San Francisco 7, Calif., on billboards of **Ghaster Outdoor Advertising, Inc.**, Lima, Ohio.

SEVENTY-TWO FEET of trim in six sections are shown being lifted out of their carton. Light weight makes handling easy. Reinforced plastic trim can be sawed, punched, drilled and riveted. It's screwed to a metal bracket for mounting or nailing to billboard's wood stringers.



This Billboard has a Message about Reinforced Plastics

Whatever the poster, here's the trim to set it off. Season after season, the trim on this billboard stays fresh and clean without a lick of maintenance.

Weather, moisture, corrosive atmospheres—even paste—can spoil the looks of *ordinary* billboard trim. But not *this* kind—reinforced plastic made of glass fibers and BAKELITE Brand Polyester Resins.

Big as it is, this example barely hints at the possibilities in reinforced plastics for economy in construction, service, and upkeep. And to extend the range of jobs these materials can handle, Bakelite Company produces four groups of resins for reinforced plastics—epoxies, phenolics, epoxy-phenolics, and polyesters.

The point to remember is that Bakelite Company can meet *all* your needs for resins for reinforced plastics . . . tell you how to use them best in your product. Forty-five years of experience in plastics are available to you through the services of qualified representatives. Write Dept. HW-104.

BAKELITE
BRAND
RESINS FOR REINFORCED PLASTICS

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

BIPEL

"Key Unit for Perfect Pre-forming"

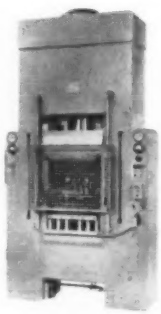
Interested in economical, trouble-free pre-forming? Famous BIPEL Horizontal Pelleters offer controlled hydraulic operation with high production speeds . . . all in a self-contained, quiet, dust-free unit! You'll get *uniform pellet density* because the free-riding die permits equal pressure (in a *steady squeeze*) by *both* punches . . . *economy* with no powder loss, low maintenance and unattended pellet discharge . . . *maximum safety* to costly dies and punches, with no moving parts ever entering between punches . . . and *service* behind your pre-former with replacement parts in stock right here for immediate shipment. All backed by BIPEL's years of production experience! Before *you* buy, *get complete information*.

maximum pressure	12 tons	35 tons	70 tons
maximum strokes per hour	2600	1500	850
typical pellet weight *	.2—1.2 oz. (1½" dia.)	3.7—8.1 oz. (3" dia.)	8.3—18 oz. (4½" dia.)

*based on average powder density of .35 ozs. per cubic inch

"BIPEL" is a Registered Trade Mark *World patents granted or pending*

BIPEL Compression-Transfer Presses are perfect companions to the Pelleters. Rejects are virtually eliminated with the famous "Auto Control", reproducing any conceivable molding cycle at the touch of a button! You'll get several extra cycles per hour, plus closer temperature control and a more effective heat transfer to the work. You'll get a self-contained drive system, or an economical out-of-the-way central system delivering 1000 psi, with pressure doubled or tripled within the press. You'll choose between 3 ranges of pressures from 20 to 340 tons. See these units in operation at Tiverton, R. I. and write for complete details.



Here are a few prominent firms who have installed BIPEL Pelleters recently:

Ucinite Company	Newtonville, Mass.
Northern Industrial Chemical Co.	So. Boston, Mass.
Romar Plastics, Inc.	St. Charles, Ill.
Harry Davies Molding Co.	Chicago, Ill.
Molded Products Div. of Admiral Corp.	W. Chicago, Ill.
Breyer Molding Co.	Chicago, Ill.
Whitso, Inc.	Schiller Park, Ill.
Van Norman Molding Co.	Chicago, Ill.
Thermo Products, Inc.	Albany, N. Y.
Pure Carbon Co.	St. Marys, Penn.
Milwaukee Plastics, Inc.	Milwaukee, Wisc.
Gordon Chemicals, Inc.	Wilmington, Del.
Gibbs Manufacturing Co.	Berkley, Calif.
Garde Manufacturing Co.	Providence, R. I.
Dolphin Molding Co.	Newport News, Va.
Dickten & Masch Manufacturing Co.	Milwaukee, Wisc.
Saxe Brothers, Inc.	Albany, N. Y.

B·I·P

B.I.P. ENGINEERING, LTD.
Streetly Works, Sutton Coldfield, England

American Inquiries to:

RALPH B. SYMONS ASSOCIATES, INC.
3571 MAIN ROAD TIVERTON, R. I.

BIPEL Hydraulic Pelleters

1955 Cadillac for your '29 Ford?

21" picture screen for your old 12"?

Automatic Bendix for your old washboard?

no...

It's a new and completely different kind of offer!

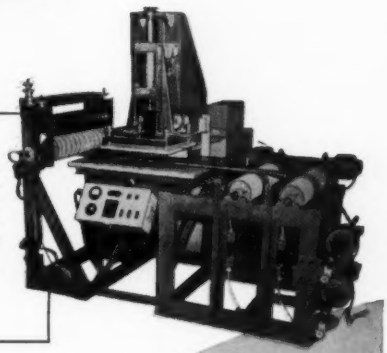
Thermatron

will give a

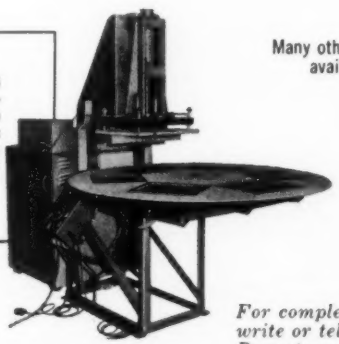
LIBERAL TRADE-IN ALLOWANCE on your present high frequency generators and presses!

You've wanted *newer* or *larger* generators and presses, *more automatic* equipment for welding of plastic... But your present investment and the additional cash outlay needed was too big for your budget.

NOW, Thermatron offers a plan whereby you can turn in your present high frequency sealing and heating equipment for a liberal allowance toward newer, larger units that increase production and cut costs!



Thermatron Automatic Indexer used in conjunction with Thermatron electronic generator, feeds, indexes and rewinds complete rolls of vinyl in one automatic operation.



Large Thermatron P16 Press and automatic turntable used in conjunction with Thermatron electronic generator can be adjusted for up to 24 indexes per revolution.

Many other models available.

THERMATRON *for*

- **Plastic sealing**
- **Glue drying**
- **Reinforced fibre glass curing and asembly**
- **Plastisol curing**

...And many other applications

For complete information, write or telephone now to Department 96

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In Radio and Electronics Since 1922

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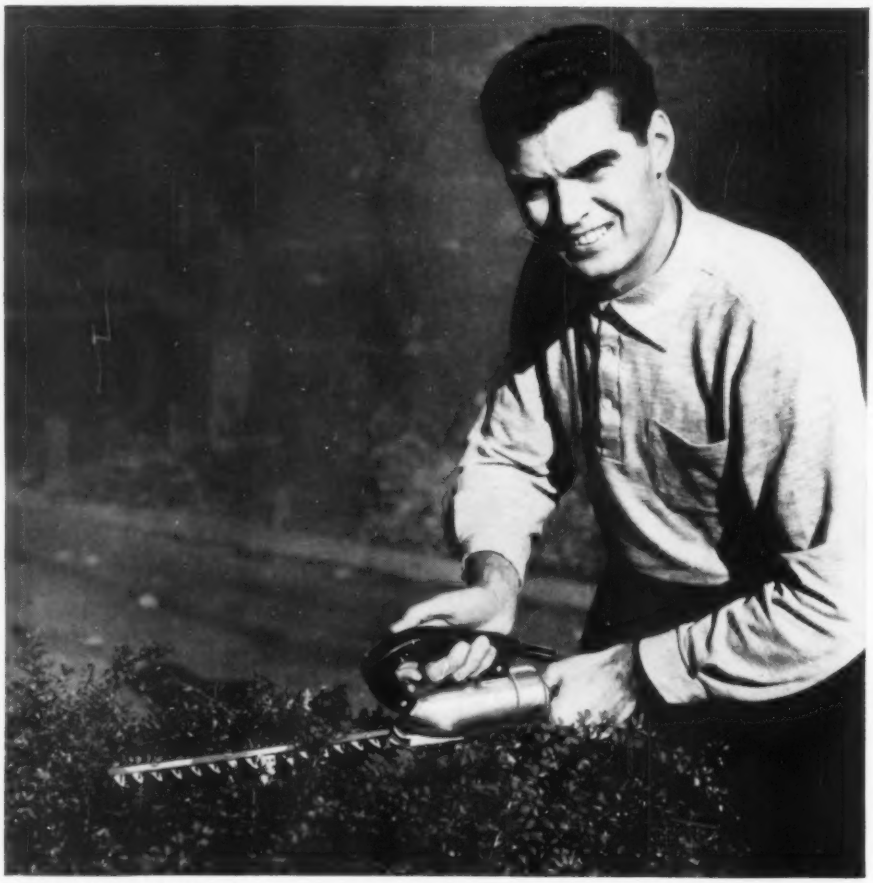
FOR PRODUCTS ON THE MOVE



KEEPS HEDGES IN TRIM . . . A trim tool itself with its handsome and durable Hercocel handle, the new Yardmaster Hedgshear quickly and easily trims hedges and shrubs.

LOOKS AS WELL AS IT WORKS . . . Yardmaster Hedgshears are precision-built by Porter-Cable Machine Company, Syracuse, New York. Attractively styled handle is molded by Thermold Corp., Manlius, N. Y., with flame-resistant Hercocel A for safety and durability.

The Yardmaster Hedgshear turns a chore into fun—trims hedges, trees and shrubs in minutes and with professional results impossible with hand shears. The Hedgshear is a precision product throughout. Upper and lower cutter bars are fine hardened steel, the razor-sharp teeth are self-honing, and the curved handle for guiding the cutter is made of long-wearing, flame-resistant Hercocel.

It's no accident that manufacturers turn to Hercocel—Hercules® cellulose acetate—whenever they need a plastic that can take it. In design, production, and sales, versatile Hercocel can be counted on to keep your products on the move.

Cellulose Products Department

HERCULES POWDER COMPANY

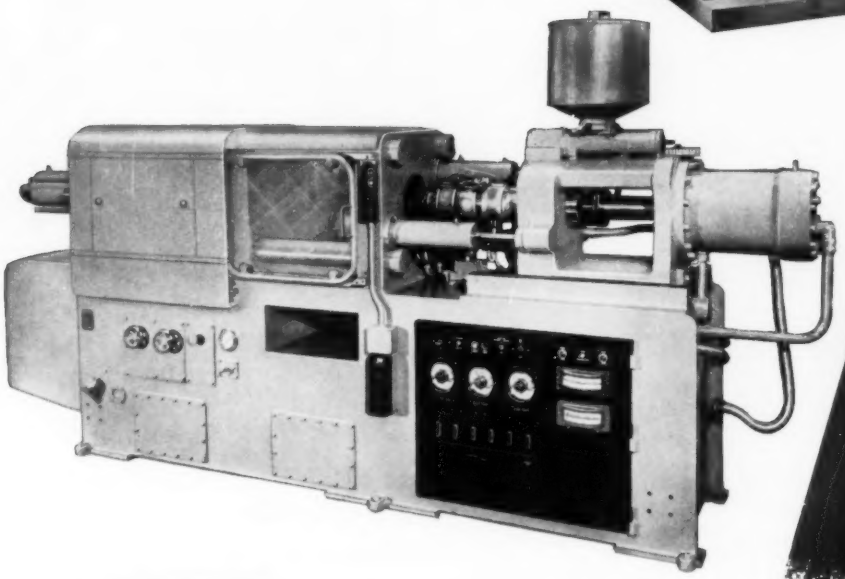
INCORPORATED

916 Market St., Wilmington 99, Del.

CP55-3

INJECTED or EXTRUDED

Above
PECO 2½" Universal Extrusion Machine



Left
PECO 30cm Injection Moulding Machine

PECO

MAKE THE MACHINES -THAT DO THE JOB

Peco Injection Moulding Machinery is now well established throughout the world as equipment in which the best engineering skill and experience are combined with the latest developments in plastic technology.

A recent addition to the PECO range of machines for the plastics industry is the 2½" Universal Extrusion Machine which is illustrated above.

Illustrated literature is available on all PECO products and will be gladly sent on request.

PECO PRODUCTS

PECO MACHINERY SALES (Westminster) LTD.

28, VICTORIA STREET : : LONDON, S.W.I. : : ENGLAND

Telephone: ABBey 1793/4/5 Telegrams: PROFECTUS, SOWEST LONDON Cables: PROFECTUS LONDON

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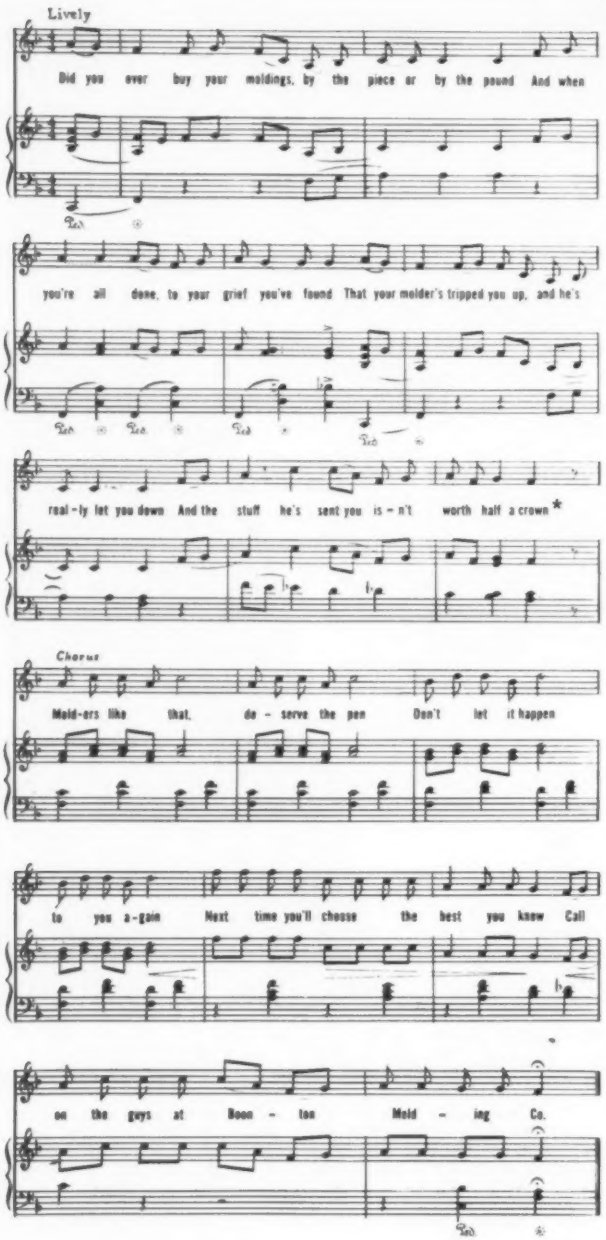
THE PROJECTILE & ENGINEERING COMPANY LTD ACRE STREET, LONDON, S.W.8

By Popular Demand



About this time two years ago Boonton brought the plastics industry its first singing commercial. In answer to many requests, here's a new one to try on your tuba . . . to the tune of "Turkey in the Straw."

**English money, y'know*

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

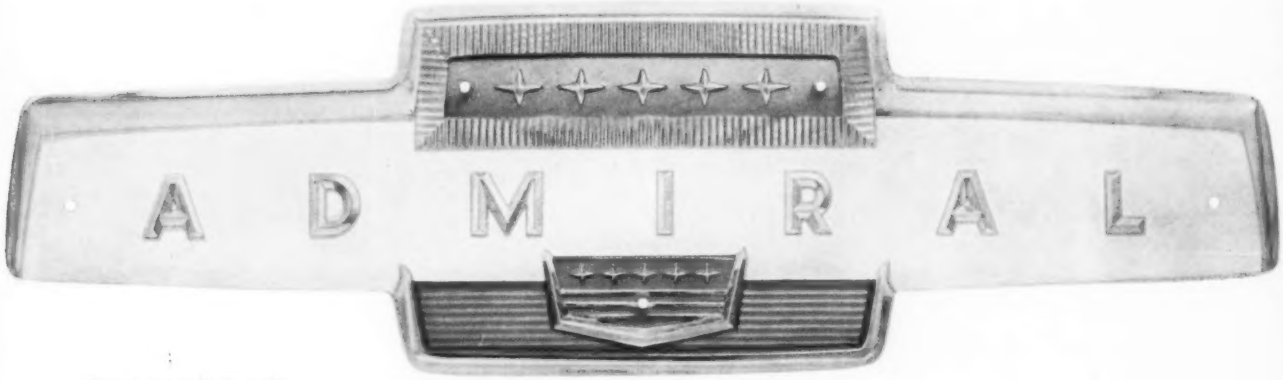
NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

Freezer Door Panel

Steering Wheel Cap

Range Control Knob

Tail Light Lens



Refrigerator Nameplate

Plexiglas ...the distinctive touch for fine products

Molded parts like those shown above combine functional value with gleaming beauty because they are made of PLEXIGLAS. This acrylic plastic has outstanding resistance to breakage, discoloration, weather and corrosion.

The combination of rich, brilliant appearance and rugged durability is the reason PLEXIGLAS acrylic plastic is chosen by manufacturers to give added sales appeal and serviceability to their products. You find parts molded of PLEXIGLAS, for example, on cars, home appliances, outdoor lighting fixtures, optical equipment and industrial pumps. Our brochure "Molding Powder Product Design" tells how and where to use PLEXIGLAS. We would like to send you a copy.

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

Canadian Distributor: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis St., Toronto, Ontario.

"Okay...how do you pronounce it?"

Lots of people
stumble over our name.

But just so you'll know,
HINDE rhymes with "find"...
and DAUCH is pronounced "dowk."
And any way you say it,
it stands for quality in
corrugated boxes.

HINDE & DAUCH

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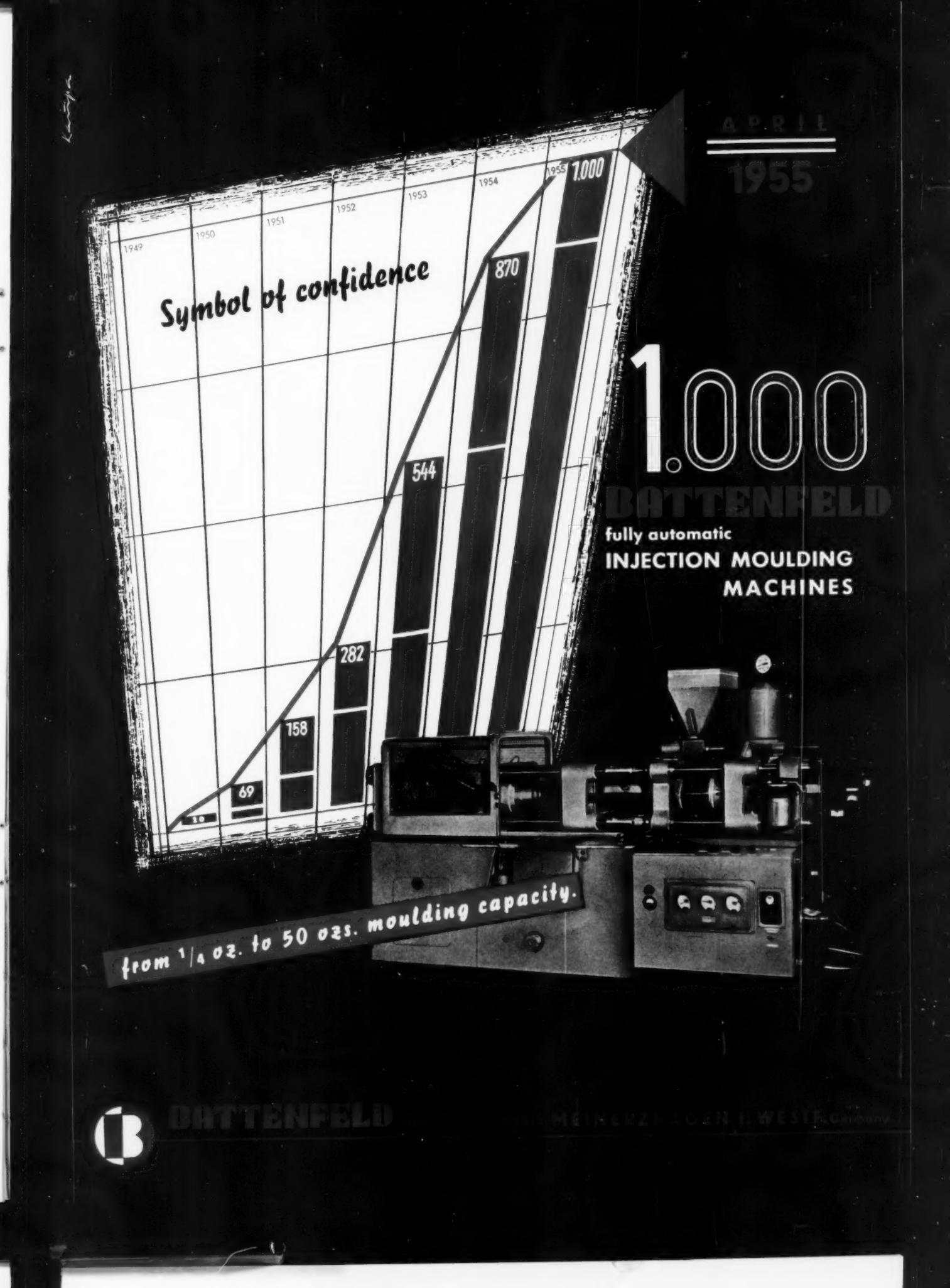
12 FACTORIES • 40 SALES OFFICES


APRIL
1955
Symbol of confidence
1949
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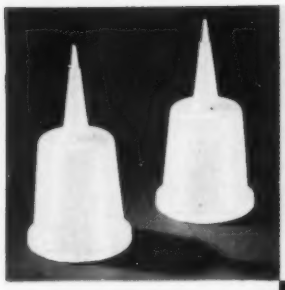
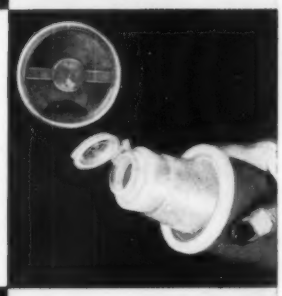
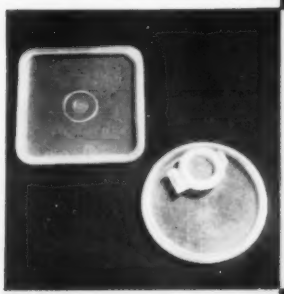
1951
1952
1953
1954
1955
10
69
158
282
544
870
1.000
1.000
BATTENFELD
fully automatic
INJECTION MOULDING
MACHINES
from 1/4 oz. to 50 ozs. moulding capacity.
BATTENFELD



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

TUPPER! TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices: Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q. Showrooms: 225 Fifth Ave., N. Y. C.

Address All Communications To: Dept. M-7

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The Secret is Out!

Competition is using IMPCO PLASTIC MOLDING MACHINERY. They are taking advantage of this "Plus Value" equipment. They know that in an Impco, they get more than a new product—not only a modern machine, but a machine designed for the future—and in addition, they get service—the kind of service they must have!

To attain a solid competitive position, you, too, cannot afford to overlook these "Plus Value" advantages.

Investigate now! Ask for a demonstration.

IMPROVED MACHINERY INC.

NASHUA • NEW HAMPSHIRE

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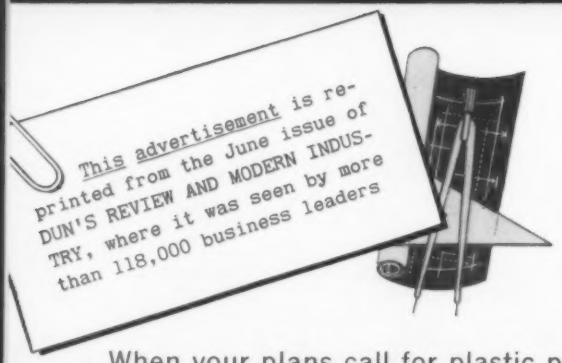
Craftsmen of the 20th Century

No. 4 of a series to introduce you to some of industry's outstanding plastics craftsmen



The artisans of bygone days applied their skills to wood and glass, to silver and iron.
Today, a fabulous new family of materials is channeling talents in new directions. Modern craftsmen are designing products in versatile plastics and mass-producing them at reasonable cost.
Pictured here are two of the specialists who are creating plastic products that are serving every industry, every home.
Monsanto, a major producer of high-quality plastic materials, salutes these craftsmen who are helping to mold America's tomorrow.

When your plans call for plastic parts or products, consult an expert custom molder

Karlo E. Jamsa, Worcester Moulded Plastics Co., Worcester, Mass. "Gene" Jamsa began his plastics engineering career 18 years ago. As Foreman of the Mold Department he now supervises 24 machinists and keeps 20 injection molding presses humming at top capacity 24 hours a day. His company provides a complete start-to-finish custom molding service and specializes in appliance parts like radio cabinets, trim panels, knobs, television masks, escutcheon plates, refrigerator and air conditioner elements. The quality of these products puts appearance high on the list of strict engineering specifications to which this type of work must be held.

John Pouhe, Chicago Molded Products, Chicago. As Injection Molding Superintendent, Mr. Pouhe supervises the production of 250 molders, finishers and inspectors. He is one of the industry's pioneers in injection molding and has served his company for 25 years. Industries for which he has solved molding problems include appliance, automotive, radio, packaging, television and plumbing—with parts ranging from fine dials and tiny knobs to large refrigerator components. Just recently Mr. Pouhe pioneered the molding of double solenoid valve housings, complete with threads, cut-outs, flanges and taps.

MONSANTO CHEMICAL COMPANY,
PLASTICS DIVISION, SPRINGFIELD 2, MASS.

MONSANTO

LUSTREX
Styrene Plastic

Keep up the pace . . .

with STANDARD MOLDING PRESSES

If today's insistent demands for increased production of thermosetting plastic products are taxing your facilities, the toggle principle of operation, as used in Standard Presses, can help you clear the hurdles.

3 REASONS WHY . . .

— HIGH PRODUCTION RATE

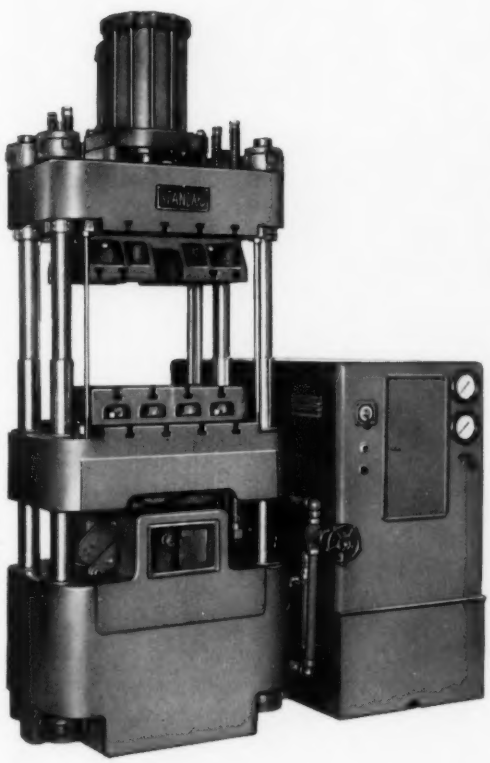
Toggle action is "fast in the clear—slow, smooth and *uniform* in the close." Best for insert requirements. Rejects are minimized.

— UNMATCHED FLEXIBILITY

Presses mold accurately at any pressure from one-third to full rating. Pressure settings are *sure*, easily adjustable. Standard models are available for both compression and transfer molding, with semi-automatic or manual controls.

— MINIMUM COST

Low initial cost. Low operating cost — low pressure hydraulic system assures power savings. Low maintenance cost — firm parallel closing of toggle action minimizes mold wear, guarantees uniformity of parts.



Standard Molding Presses are available in the following sizes: 50, 100, 125, 150, 200, and 300 tons. Write today for full details. We're ready to serve you.

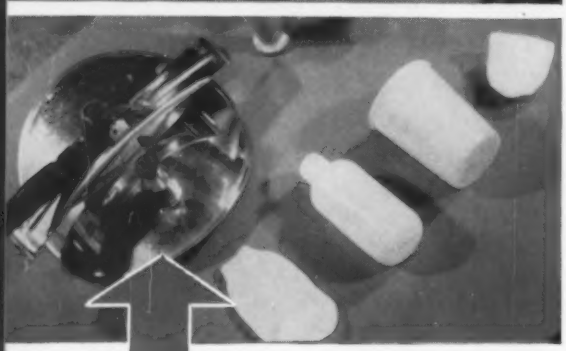
HULL-STANDARD CORPORATION

ABINGTON, PENNA.

STANDARD MOLDING PRESSES — 30 YEARS OF SERVICE TO THE PLASTICS INDUSTRY

Koppers announces

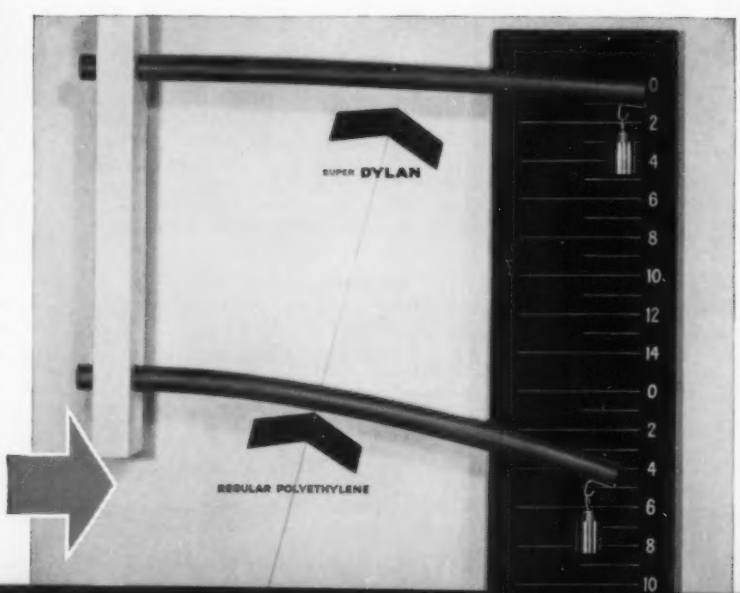
–a revolutionary new molding material that combines . . .



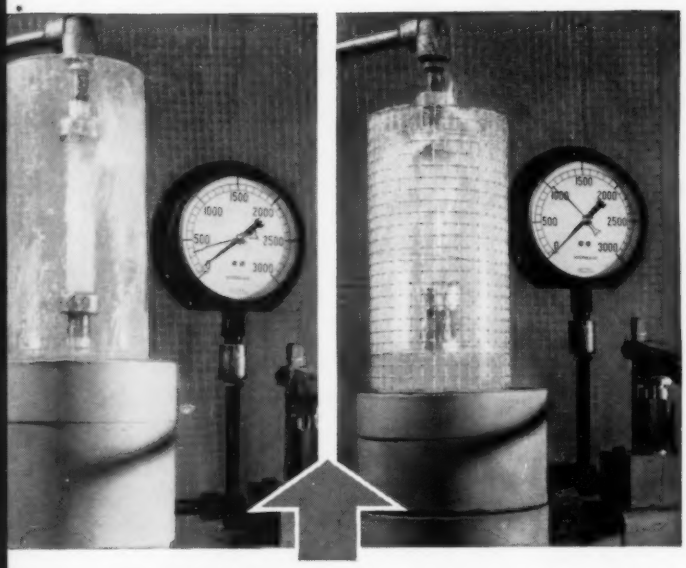
- HEAT RESISTANCE
- RIGIDITY
- CHEMICAL RESISTANCE
- LOW-TEMPERATURE TOUGHNESS
- TENSILE STRENGTH
- EASY PROCESSING
- QUALITY SURFACE
- COLORABILITY

HEAT RESISTANCE Results of pressure cooker test speak for themselves. Cooked for 15 minutes at 250° F., the ordinary polyethylene containers collapsed completely. The Super Dylan containers underwent only a two per cent dimensional change, without deformation and without loss of surface finish.

RIGIDITY These lengths of pipe are mounted only at one end. Identical weights are hung on each. Ordinary polyethylene deflects 5 inches while Super Dylan pipe carries the load easily with only 1¼ inches deflection. In couplings, as well as the pipe itself, Super Dylan Polyethylene has the rigidity, tensile strength, chemical resistance and heat resistance necessary for these applications.



SUPER-DYLAN* POLYETHYLENE



TENSILE STRENGTH Here is an actual burst test. Ordinary polyethylene is shown bursting at 350 pounds per square inch gage pressure. Super Dylan pipe is shown bursting at over 1000 pounds per square inch—almost three times as great strength. In addition, tests in boiling water show that Super Dylan pipe has approximately the same burst strength at 212° F. as ordinary polyethylene displays at room temperature.

SUPER DYLAN POLYETHYLENE, manufactured only by Koppers, opens new avenues of application as a result of characteristics such as greater heat resistance, greater structural stiffness and better appearance than heretofore available in polyethylene. Processing of Super Dylan material is easy. In conventional plastics molding equipment, this new plastic is well within the normal range of molding temperatures. The end product is smooth, glossy—really beautiful in appearance. What's more, a wide range of colors is possible.

With its improved properties, Super Dylan polyethylene should be excellent for applications such as toys, kitchen ware, radio housings, steering wheels, pipe and fittings, bottles and carboys, packaging films, washing machine agitators, refrigerator parts and battery cases.

Investigate Super Dylan polyethylene—discover what its unique combination of properties will mean to your products.

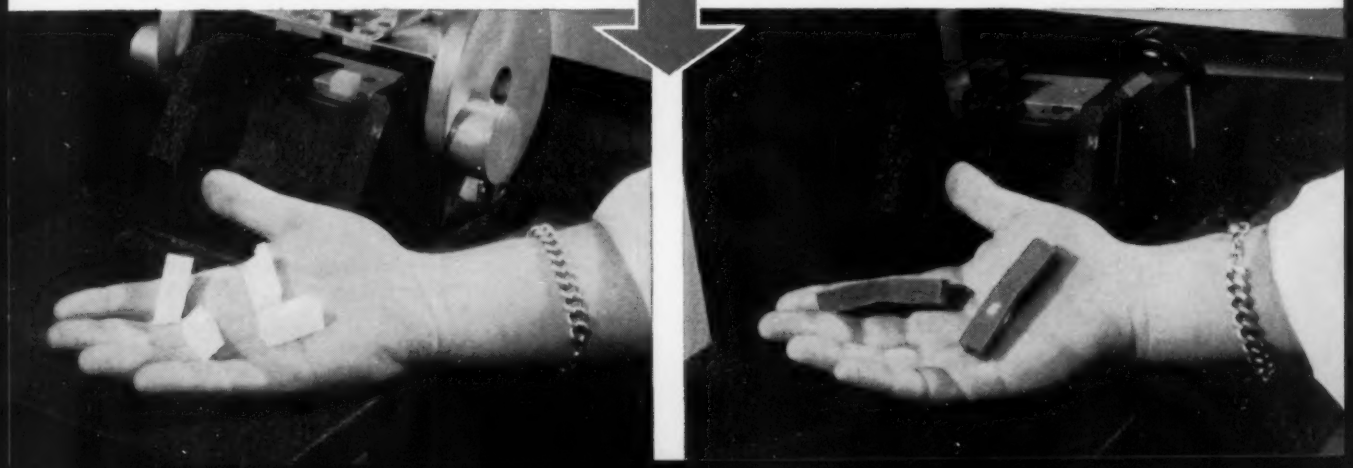
*Koppers trademark

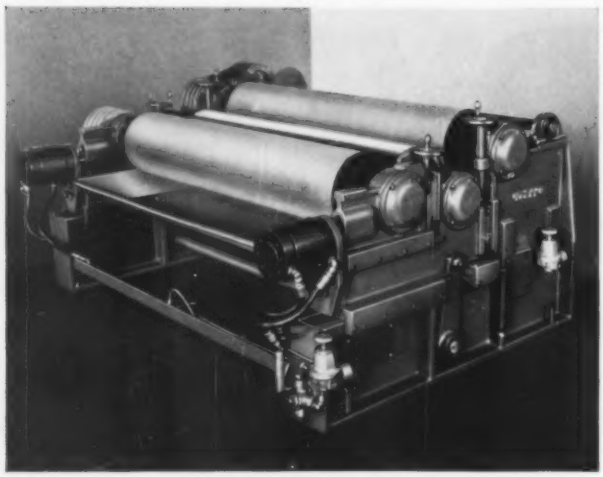
KOPPERS®

KOPPERS COMPANY, INC.
Chemical Division, Dept. MP-75
Pittsburgh 19, Pennsylvania

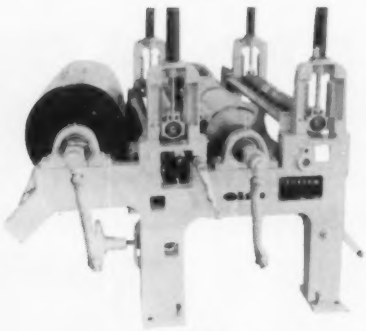
Koppers Plastics

LOW-TEMPERATURE TOUGHNESS Ordinary polyethylene and Super Dylan samples were placed in dry ice overnight. They were then placed in an Izod Impact Tester. At the bottom of its swing, a heavy pendulum strikes and either stops or breaks the sample. Ordinary polyethylene broke—Super Dylan material remained unbroken.

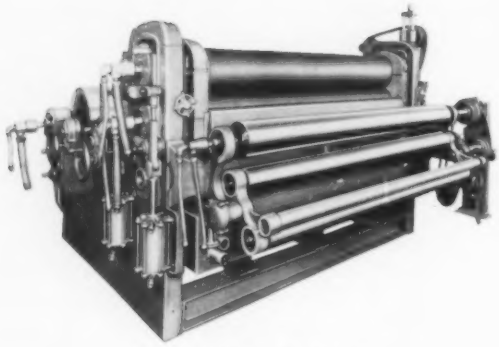




1. Moisture Applicator



2. Hot Melt Coater



3. 3 Roll Wet or Dry Waxer

Dilts

COATING MACHINES FOR EVERY APPLICATION

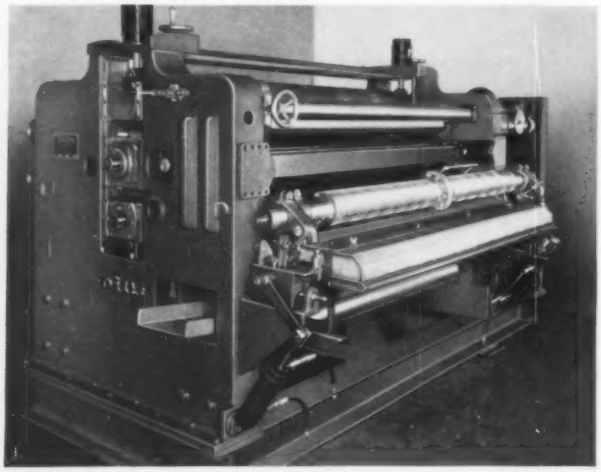
Improved coating methods are constantly being developed, tried and proved at Dilts' modern coating laboratory in Fulton, N. Y. The combination of Dilts engineering and the practical experience of leading converters results in coating machines of advanced designs and superior performance.

In all probability, Dilts has a machine to meet your specific coating requirement regardless of what materials are involved. If not, they have the facilities and knowledge to solve your problem. *When it comes to coating . . . come to Dilts.*

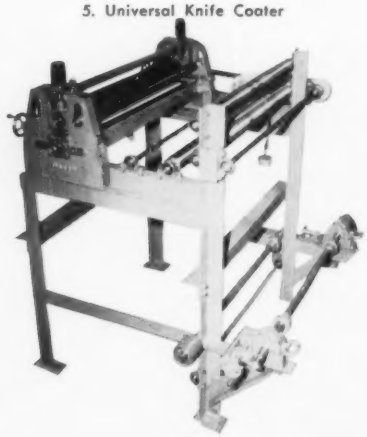
THE BLACK-CLAWSON COMPANY

DILTS MACHINE WORKS DIVISION • FULTON, N. Y.

4. *Contracoater** Reverse Roll Coater with *Warren* Air Knife



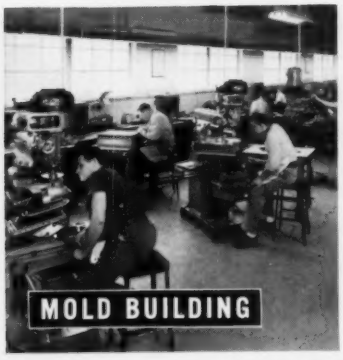
5. Universal Knife Coater

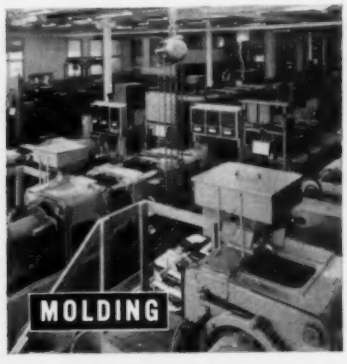


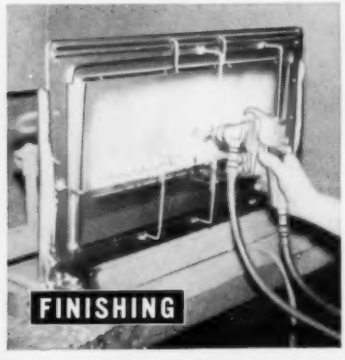
for Everything your product needs in plastics

- Product Design
- Engineering
- Mold Building
- Injection Molding (4 to 200 Ounce Capacity)
- Conveyorized Assembly
- Multi-Color Finishing
- Vacuum Plating
- Silk Screening
- Hot Stamping
- Roller Coating
- Printing
- Spray Painting
- Packing & Shipping

One call for all . . . no divided responsibility







Helping keep your product *ahead* of competition is the *purpose* and *privilege* of Amos complete facilities pictured above.

Particularly helpful . . . in *pepping up* products and *stepping up* sales . . . is the last facility "pictured"—Amos *ingenuity* and *experience*.

As you'd assume, Amos success in pioneering *new* applications usually results from *close* design and engineering *team-work* with customers.

Amos invites you to join this ever-growing customer list—including many of the best-known names in American industry. *No obligation—phone, wire or write.*

AMOS MOLDED PLASTICS • EDINBURG, INDIANA

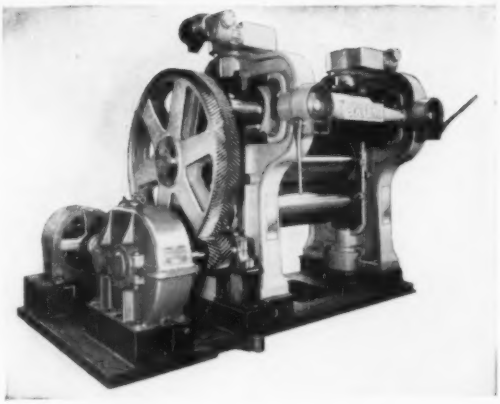
Offices: Chicago, Detroit, Philadelphia, Kansas City, Mo., Nashua, N. H.

Injection Molding & Finishing Specialists

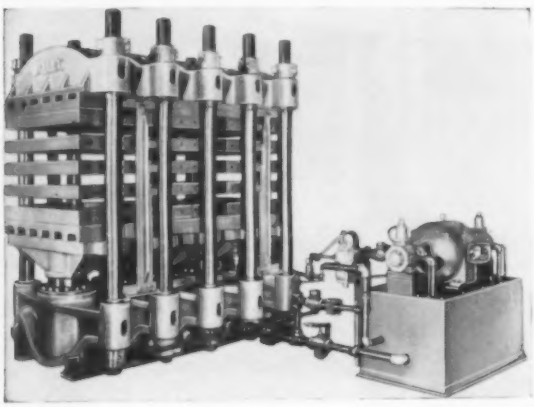
BOLLING MACHINERY for PROCESSING PLASTICS

Intensive Mixers • Calenders • Mills • Presses

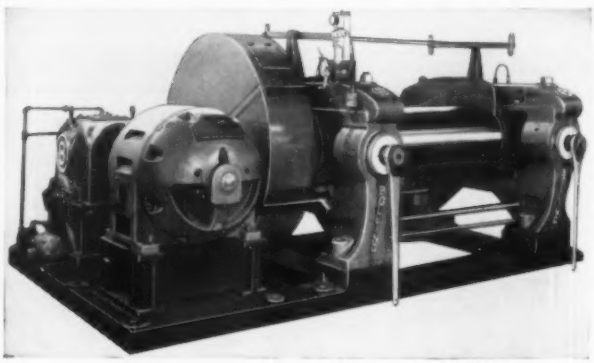
Bolling offers you a specialized line of modern, accurate, dependable machines for the processing of plastic materials. Included particularly are the widely used Bolling Spiral-Flow Intensive Mixers; 2-roll mixing and warming mills; 2-, 3- and 4-roll calenders, and hydraulic presses of the compression-transfer types. Bolling's advanced construction methods and engineering counsel are at your command.



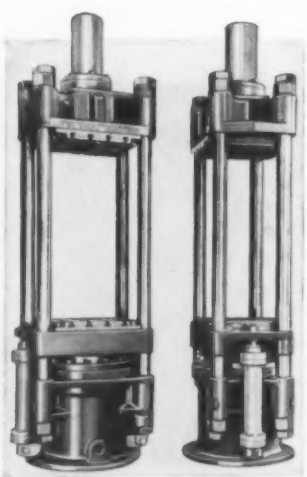
Bolling 4-roll film calender, 20" x 58". Standard models in 3-roll and 4-roll types, 12" x 32" through 24" x 68". Individual motorized screw-down at each roll end. Floor-level mounting on single-piece cast base.



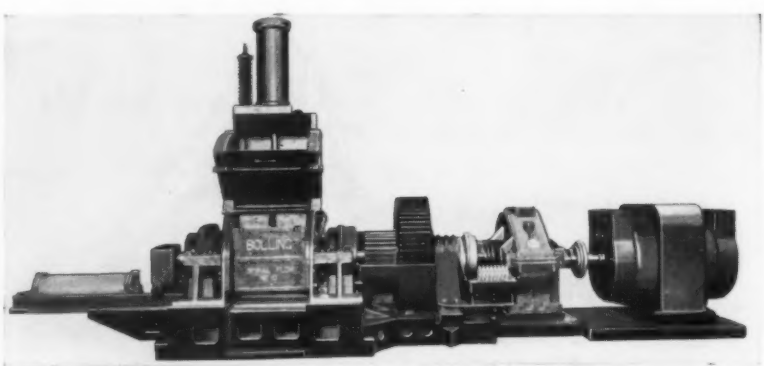
54" x 100" Bolling multi-opening, laminating press. Wide range of sizes and tonnages.



Standardized, modern designs for every milling or sheeting requirement. Compact floor level drives. 10 frame sizes, 7" through 84". (22" x 60" heavy duty right angle drive illustrated).



Bolling transfer press, 24" x 24", 250-ton, 18" ram, 18" stroke.



No. 10 Bolling Intensive Spiral-Flow Mixer for batch of approximately 325 pounds, with 250 h. p. drive.

STEWART BOLLING & COMPANY, INC.

3196 EAST 65TH STREET • CLEVELAND 27, OHIO

• INTENSIVE MIXERS AND MILLS • CALENDERS • REFINERS • CRACKERS HYDRAULIC PRESSES • PUMP UNITS BALE SLITTERS • SPEED REDUCERS

Facts You Should Know About National Aniline's Commercial Production of Tolylene Di-isocyanates

®National NACCONATES*

These simple facts are important to every present and potential user of di-isocyanates:

National Aniline through Allied Chemical resources is basic in every essential raw material needed for the manufacture of di-isocyanates . . . hydrocarbons, nitric and sulphuric acids, hydrogen, chlorine, carbon monoxide, alkalis, aromatic solvents, etc. To our knowledge, no other producer enjoys this advantage.

National Aniline and Allied Chemical experience in phosgene and diamine production spans over 35 years. To our knowledge, no comparable experience exists on the American continent.

We now have commercial-quantity production of Nacconate 80: can furnish other Nacconates for commercial development work (See list below). Additional mass-production plant facilities are now under construction.

Now available for immediate delivery in commercial quantities from Buffalo, N. Y., subject to prior sale:

National NACCONATE 80 Isomeric mixture of 80% 2, 4-tolylene di-isocyanate and 20% 2, 6-tolylene di-isocyanate

Also available for commercial development work:

National NACCONATE 65 Isomeric mixture of 65% 2, 4-tolylene di-isocyanate and 35% 2, 6-tolylene di-isocyanate

National NACCONATE 100 2, 4-tolylene di-isocyanate

National NACCONATE 200 3, 3′ bitolylene 4, 4′-di-isocyanate

National NACCONATE 300 Diphenylmethane 4, 4′-di-isocyanate

We invite inquiries for samples, technical data and quotations.

Watch the editorial and advertising pages of this publication for additional information on National NACCONATES

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Allied Chemical

Boston Providence Philadelphia Chicago San Francisco Portland, Ore. Greensboro Charlotte Richmond Atlanta Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto

In the World of Plastics a Star is Born!

MARLEX*

Called "the greatest advance in plastics since 1939" MARLEX opens entire new areas of application.

MARLEX, a revolutionary new family of plastics developed by Phillips Petroleum Company scientists, is opening a new era in plastics and packaging technology. It represents what is probably the most important forward stride in plastics development since the first commercial production of polyethylene in 1939.

MARLEX is a *new kind* of "polyethylene". . . tougher, stronger and more versatile than any conventional polyethylene now available. Members of the MARLEX family range from an exceptionally rigid, highly crystalline ethylene polymer to more flexible materials of lower crystallinity. MARLEX permits manufacture of stronger products with less material.

The ability of MARLEX to withstand heat, and its superb resistance to penetration by moisture, gases, oils and chemicals provide outstanding protection in plastic packages, bottles, tubes and bags. Under identical test conditions, the tensile strength of MARLEX 50 exceeds 4,500 psi against less than 2,000 psi for a typical present-day polyethylene. It does not soften at temperatures as high as 250° F. It will not become brittle at temperatures as low as 175° F. below zero. The unique MARLEX process provides precise control of quality and uniformity.

MARLEX 50 has been used and evaluated by many leading fabricators who report that it opens the way to new applications in the plastics field, and also will find wide usage in many products now made of other materials. They say it colors, molds and extrudes beautifully.

The huge demand for MARLEX cannot be satisfied at this time. But, with the building of a new plant of over 100 million pounds per year capacity by Phillips Chemical Company, a wholly owned subsidiary of Phillips Petroleum Company, fabricators of plastics will soon have substantial supplies available. MARLEX will later be made by other manufacturers who will be licensed to use the Phillips process.

Today, the biggest thing ahead in plastics is MARLEX. Forward looking manufacturers of plastic products are making their plans accordingly.

MARLEX 50

Typical Properties	Value	ASTM Test
Softening Temperature, °F	260[a]	–
Density	0.96	–
Tensile Strength, psi		
Injection Molded		D638-52T
20 in/min	5100	
0.2 in/min	3500[b]	
Compression Molded		D412-51T
20 in/min	4200	
0.2 in/min	3100[b]	
Elongation, %		
Injection Molded		D638-52T
20 in/min	28	
0.2 in/min	518[b]	
Compression Molded		D412-51T
20 in/min	20	
0.2 in/min	1175[b]	
Stiffness, psi	140,000	D747-50
Melt Index	0.6	D1238-52T
Impact Strength, Izod (ft lbs/in notch)	3.0	D256-47T
Brittleness Temperature, °F	−180	D746-52T

[a]Adapted from method of Karrer, Davis and Dieterich, *Ind. and Eng. Chem. (Anal. Ed.)* **2**, 96 (1930).
[b]Test specimens did not break when pulled to the limit of the testing machine.

GAS PERMEABILITY Cc x Cm/Sec x Sq Cm x Cm Hg

Gas	MARLEX 50 Film Px 10[9]	High Pressure Polyethylene Film Px 10[9]
Carbon Dioxide	0.214	1.22
Hydrogen	0.199	0.794
Oxygen	0.069	0.276
Helium	0.153	0.540
Ethane	0.146	1.23
Natural Gas	0.070	0.343

LIQUID PERMEABILITY Gms/100 sq in/mil/24 hrs

Liquid	MARLEX 50 Film	High Pressure Polyethylene Film
Toluene	59.3	390
Carbon Tetrachloride	52.0	384
n-Heptane	34.8	257
Ethyl Acetate	3.3	30.8
Amyl Acetate	1.1	5.6
Acetone	0.8	7.4
Methyl Salicylate	0.9	6.9
Ethanol	0.1	0.9

MOISTURE VAPOR TRANSMISSION Gms/100 sq in/mil/24 hrs
ASTM D697-42T (Method A at 100° F)

	MARLEX 50 Film	High Pressure Polyethylene Film
MVT	0.3	1.3

PHILLIPS CHEMICAL COMPANY
A Wholly Owned Subsidiary of Phillips Petroleum Company
Bartlesville, Oklahoma

*A Trademark

New Lantuck-NR® helps vinyl make news in the '55 Dodge

New Dodge Custom Royal Lancer V-8 features headlining, bolsters and door panels backed by Lantuck.

The beauty of the Dodge's new interior styling is no longer news. But the fabric backing the vinyl material over the young lady's head is news—important news for industry.

It's one of the first uses of a completely new Lantuck non-woven backing fabric—Lantuck-NR. Designed from the start to reinforce vinyl film or coating, its random distribution of nylon and rayon fibers are bonded with a special agent for really remarkable strength and elasticity.

Lantuck-NR gives vinyl: 1. high tear strength; 2. outstanding stretch and recovery; 3. easier, neater tailoring; smooth, even surface—no clothiness; 4. good embossing surface; 5. durability and economy; 6. equal tensile strength, tear and stretch characteristics in all directions.

This Lantuck-NR backed vinyl headlining was supplied by Textileather Division of General Tire and Rubber Co., under its own trade name, Nygen Tolex.

But that's not all. There's more to this interior story. Vinyl-quilted Lantuck was used in the bolsters and door panels of this new Dodge and was supplied by National Automotive Fibres, Inc.

Our nearest sales office has full details on new Lantuck-NR as well as any other Lantuck fabric for a wide variety of coating and laminating applications.

Wellington Sears

A Subsidiary of West Point Manufacturing Company

FIRST In Fabrics For Industry

**LANTUCK: Registered trademark of West Point Mfg. Co. for its non-woven fabrics.*

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

For vacuum and pressure forming
Nixon features . . .

the Big 4

- **rigid vinyl**
- **high-impact styrene**
- **cellulose acetate**
- **cellulose acetate butyrate**

Expect big things from these formable sheets, now that vacuum and pressure forming are established as major fabricating techniques. Because large-volume, low-cost production is possible in ways that have never been possible before, more and more doors open every day. In packaging alone the rush to formed plastics is phenomenal. And what materials are being used? The big 4!

Nixon has them all, a complete line, which right from the beginning of vacuum forming attracted some of its most important pioneers. Why? Because Nixon sheets take particularly well to pre-printing, deep draws and intricate color designs.

Such outstanding quality can always be expected from Nixon, one of the oldest, most reliable names in plastics. Formable sheets are always available in almost every color, size, gauge. Any one of our representatives will gladly give you further details.

NIXON NITRATION WORKS—founded 1898 Nixon, New Jersey, Phone: New Brunswick, Charter 9-1121, New York Extension WOrth 4-5290

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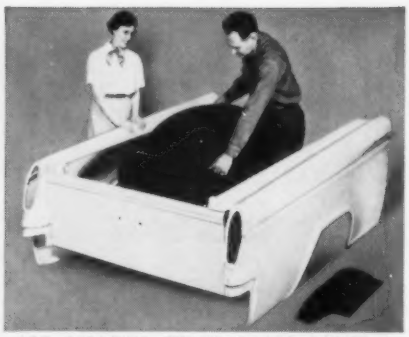
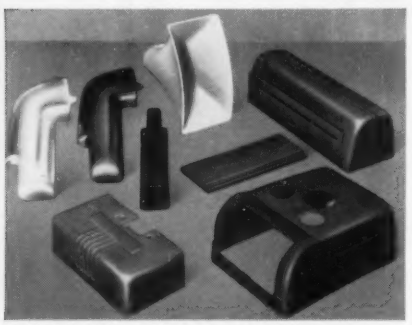
Nixon PLASTICS

BOB MORRISON and Hal Lathrop, company executive, inspect a truck spare-tire carrier, one of many parts made with HETRON resins at Molded Fiber Glass Body Co., Ashtabula, Ohio.



ALL MOLDED FIBER GLASS PARTS for this pickup are molded by the Body Co., and all use HETRON resin. These parts combine high reverse impact with excellent flexural strength. The ultra-smooth "showroom" surface will take a baked-on alkyd finish without cracking or crazing.



MORRISON CUTS hand-finishing costs as much as 50% by using HETRON on parts like these. HETRON gives a glossy, well-filled surface—beautiful as is, or with a baked-on finish.

"I get the quality moldings I want—with HETRON"

says **Bob Morrison,** *President, Molded Fiber Glass Body Co.*

It's no easy job to meet the requirements of the automotive industry for reinforced polyester body parts.

But Bob Morrison is doing it. Here, in his own words, he tells *why* he molds with HETRON:

"To make good matched-metal-die moldings of auto body and other large parts, we find it advantageous to use a polyester with the resiliency of a semi-rigid resin, plus the flexural strength of a rigid resin.

"The resin must come through a short cure with practically no surface shrinkage. It must give us an extra-smooth, glossy surface, using the normal resin-to-glass ratio—and with a bare minimum of hand finishing and rejects.

"Then the finished part must take a baked-on alkyd finish at the customer's assembly plant, without a trace of surface crazing.

"It's worth paying a few cents more per pound for resin that gives us results like these in the finished product.

"We get this kind of quality with HETRON resins. Our cost is lower in the long run, because HETRON substantially reduces the amount of hand finishing we have to do."

Bob Morrison gets quality moldings —and so can you—with HETRON.

HETRON resins come to you with permanent, built-in flame resistance. This added bonus can be utilized to its highest degree with the proper choice of fillers.

If you need an assembly, a single part, or a molding material with properties like these, you'll save time by specifying a HETRON resin. HETRON costs a little more. But it gives you results worth a *lot* more.

You'll find technical information on HETRON® resins in your Sweet's Product Design File. Or write us today for complete technical data, and names of fabricators who can supply you with HETRON-based material.

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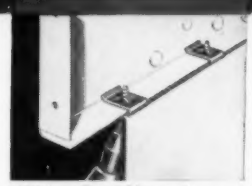
FASTEST THING IN FASTENINGS®

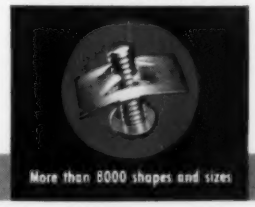
TYPICAL USES



"U" type SPEED NUTS cut assembly costs, maintenance on farm equipment.

Special SPEED NUT eliminated production problems on washing machine motor mount bracket.

SPEED GRIPS eliminated costly repairing of truck radiators returned because of weld breaks.



News about

B. F. Goodrich Chemical *raw materials*

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Good-rite Resin 50—a thermoplastic reinforcing resin that is compatible with crude and American rubbers—offers the compounder many important advantages.

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Good-rite Resin 50 is produced as a finely divided, free-flowing, odorless white powder, easily blended with other polymers. To find out how Resin 50 will enable you to make *better* products at *lower costs*, please write Dept. CF-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

makes premium products

You'll find Resin 50 in the recipe wherever the product needs superior flex life, hardness without sacrifice of strength, improved abrasion resistance, and light weight. Are any of your products listed here?

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- ★ **Wire & Cable Insulation**
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B. F. Goodrich Chemical Company
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MODERN PLASTICS

JULY 1955 VOLUME 32 NUMBER 11

Vinyl molds that can be re-used repeatedly for making electrotype shells are light in weight, can be filed in small space for future use. Vinyl sheet, separating paper, and molding blanket are placed over type form (right). After heat and pressure are applied, finished mold is stripped off (below)

PARING PRINTING COSTS With PLASTICS

Photos courtesy The Monomelt Co. Inc.

EVER since Gutenberg's invention of movable type, advances in communication have depended largely upon the introduction of better and faster methods of multiplying the printed word. In recent years, plastics materials—notably phenolics and vinyls—have played an increasingly important role in the art of printing. As engravers, printers, and publishers become increasingly familiar with ways in which plastics can pare production costs, save valuable time, and give greater scope and flexibility to printing operations, even greater progress may be expected of plastics in the graphic arts field.

In general, there are three basic types of applications in the graphic arts field for which plastics have proved particularly suitable. All of them relate to the letterpress method of printing, in which the ink is transferred to the paper, boxboard, or other surface through direct contact with raised type or engravings. Although details vary, depending upon the materials and equipment involved, these applications include female matrices from which plastic printing plates can be molded; the plastic printing plates themselves; and thermoplastic sheets which are used to expedite or improve the production of metal electrotypes used in printing.

There are a number of reasons why plastics are winning an important place in these applications. Most basic is the fact that plastics are extremely light in weight as compared to the metals, such as copper and zinc, commonly employed in printing. This means that plastics printing plates may be shipped long distances

Light backing-plates for electrotypes (above) are made of a sheet of rigid vinyl bonded to a perforated aluminum sheet. An electrotype shell is placed over the vinyl and, after heating, the assembly cooled in press (right)

Photos courtesy B. F. Goodrich Chemical Co.

at much lower cost than metal plates. They lend themselves particularly well to high-speed air shipment, where every ounce of excess weight swells delivery charges.

Another desirable quality of plastic plates is the fact that, unlike metal plates, they are not subject to corrosion. Of course, printers running plastic plates must exercise care not to damage the plates by using type washes having a solvent action upon the material. However, this does not pose too serious a problem, since gasoline, benzene, and similar liquids may safely be used.

The facility with which plastic matrices, electrotype forms, and printing plates may be made, utilizing specialized types of equipment as well as equipment already in use in the graphic arts, frequently is reflected in a saving of time and reduced production costs. The fact that plastics materials lend themselves ideally to molding and forming with only moderate heat and pressure, on relatively short cycles, means that high-quality, finished reproductions may be quickly obtained on the printed page. Plates can be made flat for use on flat-bed presses or curved for rotary press application. Their light weight is particularly important in rotary press work, where high press speeds frequently lead to operating difficulties with heavy metal plates because of the centrifugal force involved in that type of printing operation.

Female Matrix

Suppose, for example, that a national advertiser wishes to run a three-column by 10-in. illustrated advertisement in 100 newspapers from coast to coast, extolling the virtues of Zilch's zithers; this means that each paper on the list must be supplied with a printing plate which can be mounted directly on its presses and run, or used to produce a finished metal plate which will do the final printing. In preparatory steps, type is set, engravings are made from illustrations, and a complete electrotype pattern plate is made. This heavy electrotype is not ordinarily shipped to newspapers, but is used as a master for preparing duplicates

Terms Used in the Printing Industry

SINCE some of the words and phrases used in the printing industry may not be familiar to the reader, the following brief summary may assist in a better understanding of the applications of plastics described in the accompanying article.

Most important market for plastics in the graphic arts is in **letterpress** printing — the method of printing from type and/or **relief** or **positive plates** in which the raised surfaces of the plate or type are the areas that print. **Original engravings** (also called **cuts** or **plates**) for letterpress printing are made from photographs or drawings.

Engravings are of two types:

1) **halftones** which are used for reproducing photos; and

2) **line cuts** which are used for solid lines or for areas where there are no tones.

The actual printing is done either with the original plate or with **duplicate plates.**

The intermediate step in the preparation of most duplicates is the **matrix**. These matrices, formed directly from the original, are female versions of the male or positive originals. Using the matrix as a base, **stereotype** positive duplicates can be made by various casting or forming methods. In some cases, a metal shell is plated over the matrix. When the shell is removed and backed up, it becomes an **electrotype** positive duplicate.

Letterpress printing plates are made flat for use on **flat-bed presses** or curved to fit around the cylinders used in **rotary presses.** Preparing the plate for printing once it has been set up in the press is known as **make-ready.**

through the use of a female matrix or mold.

Preparation of the matrix involves transferring the exact image of the complete ad to another material which, in turn, can be used as a mold for producing the positive or final printing plates. One type of matrix material widely used for this purpose is Tenamat, produced by Tenak Products Co., Chicago, Ill. Production of Tenamat makes use of a Rogers board core to which two sheets of phenolic-impregnated paper are press-bonded. Supplied in various thicknesses and sizes, this matrix is capable of receiving and retaining a permanent impression of the pattern plate because the resin in the outer layers of paper, as well as the Rogers board core, is of the "A" stage type, ready to be completely cured upon application of heat and pressure.

To this end, the set-up to be reproduced is placed in a chase (metal frame) and metal bearers are positioned to limit the depth of the molding operation. Next, a sheet of Tenamat is placed on top of the engraving and covered by a metal pad. The complete assembly is then placed in a hot press (290 to 300° F.), with contact pressure only for approximately half a minute to soften the "A" stage resin. Pressure is then increased until the press is closed firmly against the bearers and the assembly is left in the press for 10 or 15 min. until the matrix has cured. The resulting female matrix, faithfully duplicating every detail of the original metal plate, may be used in making a number of plastic printing plates. Since the resin used in the matrix is thermosetting, the intermediate plate will not soften upon further exposure to heat.

The plastic matrix material made by another organization, The Monomelt Co., Inc., Minneapolis, Minn., is also composed of phenolic resin and the procedure followed in producing a plastic matrix is substantially similar to that for Tenamat.

Molded and Formed Plates

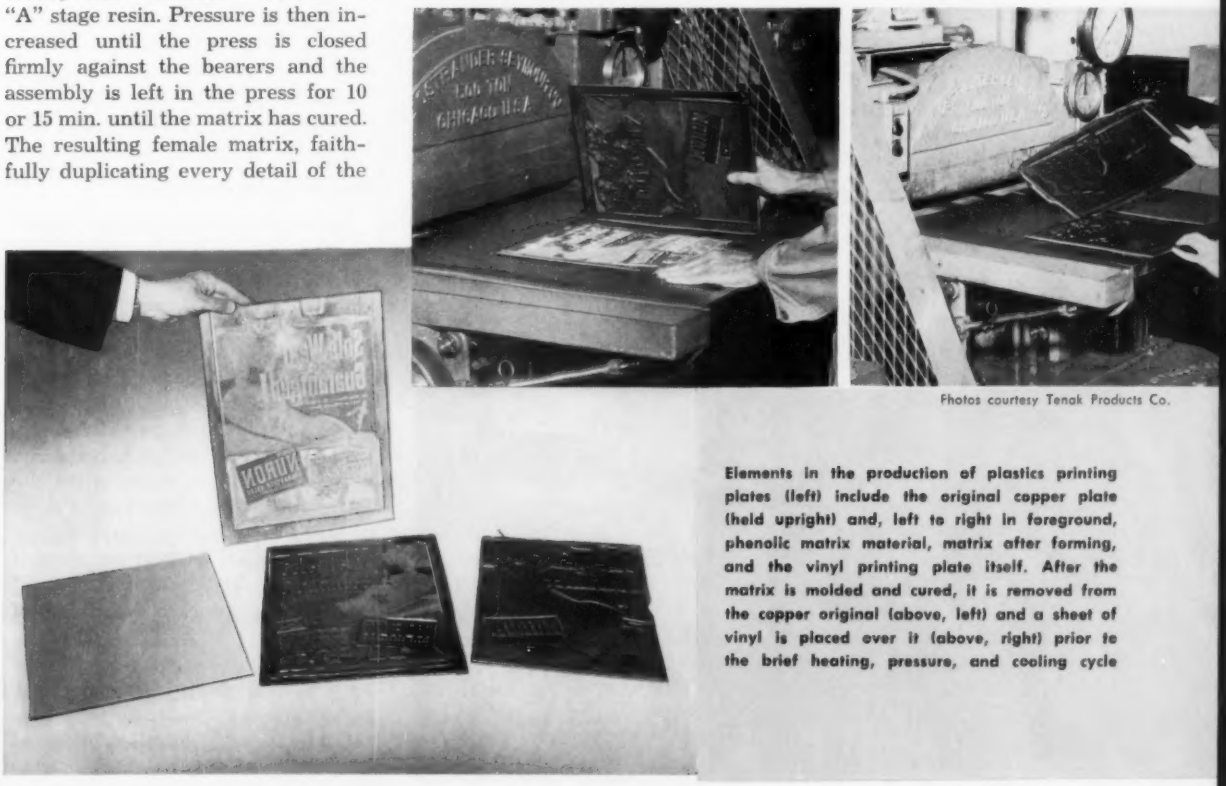
After the plastic matrix has been produced, the next step is the making of the plastic printing plate itself, which, like the original engraving or type form, is made as a male or positive plate.

In the production of one form of thermoplastic printing plate, granular Vinylite VG-9400 is used. The resin is spread evenly over the matrix, which is then placed between the heated platens of a hydraulic press. When a printing face of greater hardness is desired, a fine coating of Vinylite VYNS is first spread over the matrix, followed by the VG-9400. On heating, the thermoplastic material softens and the pressure flows it into the impressions in the matrix. Upon cooling, the plate is separated from the matrix with a broad, sharp tool.

Upon removal from the matrix, the thermoplastic printing plate may be machined on standard electrotype or stereotype equipment. The plates are used flat or, with special plate curving equipment, can be curved for use in rotary printing; shaving, beveling, and routing are done before curving.

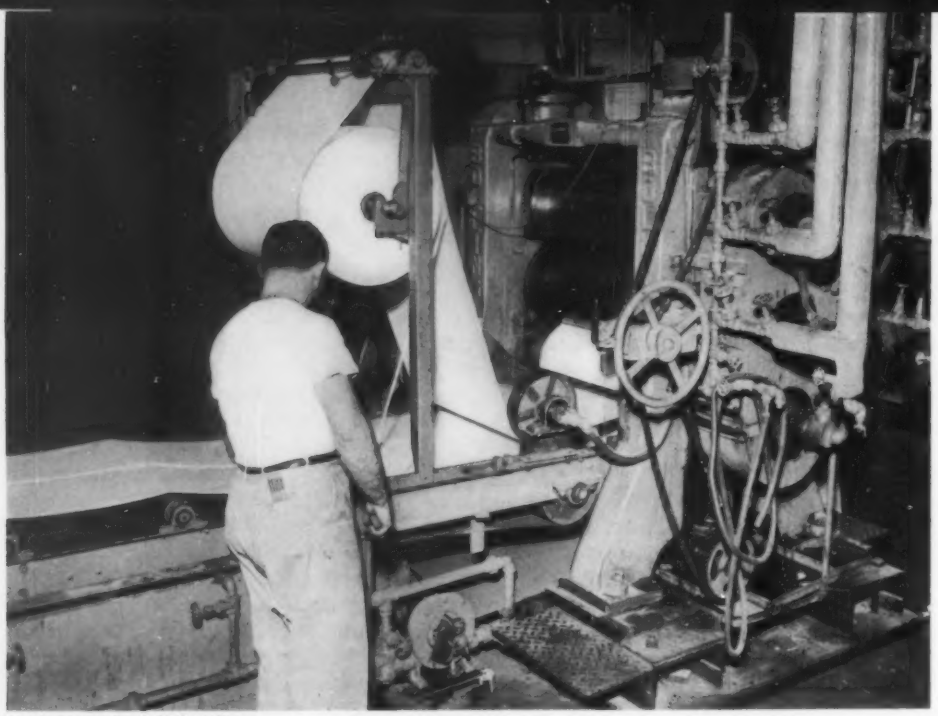
In plastics industry terms, the type of thermoplastic printing plate described above would be said to be produced by compression molding. A somewhat different procedure, which is widely used for newspaper ad plates, involves the use of a vinyl sheet which, under heat and pressure, is brought into contact with the matrix, causing the impression to be transferred to the vinyl sheet.

Such formed plates are exemplified by those made of Tenaplast, a heavy calendered sheet of vinyl (approximately ⅛ in. thick) topped with a thin layer of vinyl-impregnated tissue. In producing Tenaplast plates, the vinyl sheet is placed on the matrix, tissue side down, and an insulating panel of phenolic paper-base laminate is laid



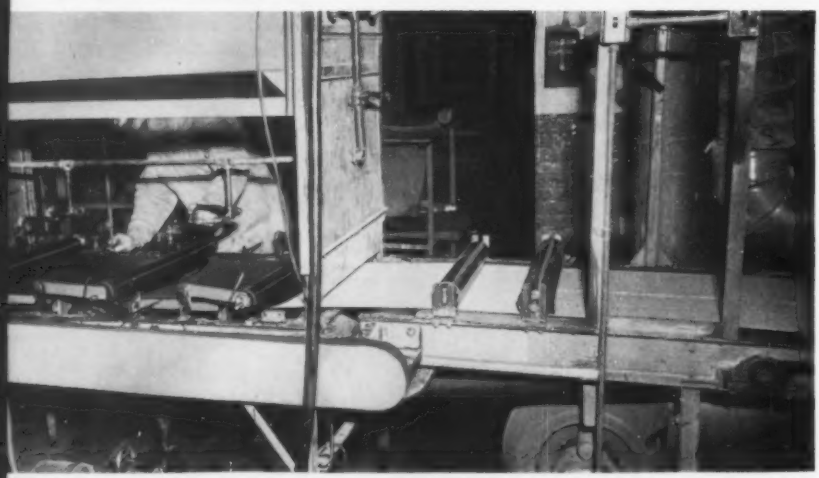
Photos courtesy Tenak Products Co.

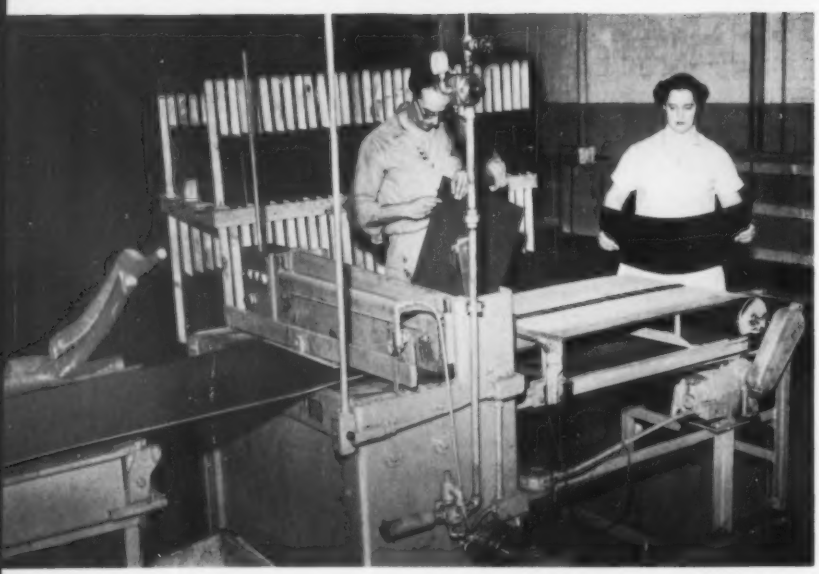
Elements in the production of plastics printing plates (left) include the original copper plate (held upright) and, left to right in foreground, phenolic matrix material, matrix after forming, and the vinyl printing plate itself. After the matrix is molded and cured, it is removed from the copper original (above, left) and a sheet of vinyl is placed over it (above, right) prior to the brief heating, pressure, and cooling cycle



In production of Tenaplast material for making plastic printing plates (see photos p. 75), vinyl compound is fed to calender where, as vinyl sheet is formed, it is combined (left) with a sheet of light tissue, which becomes the final printing surface. This tissue is impregnated with liquid vinyl which is sprayed on it (center photo) before the web passes through a curing tunnel. At end of production line, material is cut to size, checked for thickness (bottom photo) and stacked for packing

Photos courtesy Tenak Products Co.





on top. The assembly is then placed in a press and preheated with contact pressure for approximately three minutes. The "sandwich" is then removed and placed in a cold press, where a pressure of 1500 to 2000 p.s.i. is applied for several minutes, depending upon the subject to be molded.

Some publications print directly from solid plastic plates 0.152 in. thick; in other cases, plates are used to produce stereotype mats (matrices) which, in turn, are used for casting metal stereotypes.

Plate Material Production

In the manufacture of Tenaplast material used for producing printing plates from Tenamat matrices, the first step consists of combining the basic vinyl resins, coloring matter, stabilizer, and release agents in a Banbury mixer. The material is then milled on calender rolls to produce the required shrinkage characteristics, toughness, and other desired properties. As the sheet enters the final set of rolls, a continuous sheet of tissue is laid down on the web of plastic material. In the next stage of the process, liquid vinyl is sprayed on the tissue overlay by a series of nozzles.

At this stage, the calendered sheet with its impregnated tissue covering passes through a short tunnel where thermostatically controlled infra-red lamps cure the vinyl coating, fusing

the sheet into a homogenous structure. As the finished sheet emerges from the tunnel, it passes beneath an automatically operated guillotine type shearing device.

The purpose of the paper facing sheet on Tenaplast material is to provide close detail in the final printing plate. Ultimate thickness of the material is regulated by the setting of the calender rolls; gages from 0.125 to 0.210 in. are required for different types of plate work, depending upon whether the plate is to be used for direct printing or for making stereotypes.

Although the majority of plastic plates are of the thermoplastic variety, thermosetting plate materials may also be used in either granulated or sheet form. Often, both types of materials are combined in a single plate. The process followed in the molding of thermosetting plates closely parallels that used in producing thermosetting matrices.

Printing on Boxes

A specialized type of plastic printing plate designed for use by paper box manufacturers is the Permatype plate, developed under the direction of F. A. Freeman, manager of the Chicago manufacturing branch, Western Newspaper Union, and manufactured exclusively by WNU under pending patents. The perfection of this plate was based on discovery of a method of hardening the printing surface while retaining much of the resiliency of a thermoplastic plate.

Details of the structure of the Permatype plate are still held secret, but it is described as "neither a thermosetting, nor a thermoplastic, nor a metal plate," and as "a combination of materials from several categories, laminated, reacted, and integrated into a printing plate." The combination plastic plate is reported to have approximately twice the hardness of a copper faced electrotype. In addition, the Permatype plate is said to have greater affinity for ink than any all-metal plate.

Produced in a thermosetting female mold, the Permatype plate is designed to replace the conventional metal electrotype. Its specially hardened surface permits it to be used for direct imprinting of boxboard. At present, Permatype plates are limited to the flat variety, but development work is now under way on curved plates for rotary press work.

The special advantages of the Permatype plates are best realized in the production of multiples of duplicate plates, since the relatively high initial mold costs reduce or eliminate any cost advantage over other duplicate plate-making processes for single duplicates. Speed of manufacture quickly absorbs mold costs when additional sets of plates are made from the same durable master mold.

The use of plastic plates has become quite general in many book plants where the printing is done chiefly from flat bed presses, and some firms have been successful in the use of curved plastic plates for rotary printing. American Book-Stratford Press, New York, N. Y., is among the plants reporting successful work with curved plastic plates.

Mechanical Engraving

In another method of producing plastic engravings, the plate is made in a one-step operation directly from the photograph, drawing, or other matter to be reproduced. This process, known as photo-electric engraving, may be done on several types of equipment now available. It is particularly interesting in view of the fact that it is completely photomechanical in nature, very fast when the number of plates required is small, and requires little or no operator skill, in contrast to the great amount of skill involved in making metal engravings.

One type of machine which produces plastic plates by the photoelectric process is the Fairchild Scan-A-Graver, produced by Fairchild Camera & Engineering Corp. and available to the graphic arts field on a lease basis. Designed originally to provide small newspaper publishers with a method of producing halftones quickly and economically in their own plants, this unit is also proving to be of value for larger dailies when plates must be made quickly to meet a deadline.

With this equipment, the photo to be reproduced is fastened to a cylinder above which is mounted a photoelectric cell. As the cylinder revolves, the photo-electric eye "scans" the copy and the resulting electrical impulses are relayed to a heated stylus mounted above another cylin-

(*To page* 182)

Photos courtesy The Consolidated International Equipment and Supply Co.

Plastic engravings for printing are produced on the Engrav-a-Plate machine by mechanical etching with a stylus actuated by electronic means. Copy to be reproduced is placed face down (top photo) on the engraving table, the plastic plate is clamped in position, the controls are set (center), and, as copy is scanned by photo cells, engraving proceeds automatically

BETTER BODIES *For Toys that Travel*

Courtesy Steiner Plastic Mfg. Co., Inc.

Prior to lay-up of the polyester-fibrous glass body of the Ford Thunderbird, Jr., a gel coat is sprayed into the female mold

Toy car bodies fabricated of reinforced plastics or formed of vinyl sheet give new concept of quality in wheeled goods construction

DESIGNERS of motorized or pedal-driven toy automobiles have accepted with enthusiasm the idea of plastics bodies for their miniatures of the sleek rulers of the highways.

A mere handful of reinforced plastics toy auto bodies appeared as novelty items in 1953 and 1954; 1955, it is forecast in the toy trade, will see volume adoption of reinforced plastics by the manufacturers of junior-size wheeled goods. In addition, the very recently introduced miniature car bodies formed from sheets of rigid vinyl suggest fascinating possibilities for future expansion.

Mass Production

Whether miniature cars with plastics bodies can ever be made at prices that will appeal to the really big mass market for toys is a question still being debated by manufacturers. Motorized toy cars with plastics bodies sell for anywhere from $250 to $350; the more conventional pedal-driven or coaster-type cars with plastics bodies sell for $100 to $200.

In most cases thus far, the outstanding durability and performance advantages of the plastics bodies and the high-powered sales appeal inherent in their realistic appearance, offset the price factor. The extent, however, to which the application will develop into a major large-volume market for plastics depends on the degree to which mass-production techniques can be adapted.

Authentic Replicas

Two ambitious projects recently undertaken are similar in that each evolved as part of a promotion stunt by a major automobile manufacturer to publicize 1955 sports cars. In each case, emphasis was on the production of a toy auto with a life-like reproduction of the body of its adult-sized counterpart. And in both cases, plastics proved ideal.

One of the toy autos is a scaled-down replica of Ford's Thunderbird; the other is a miniature version of the Kaiser-Darrin 161, Kaiser-Willys' entry in the sports car field.

The battery-powered Thunderbird, Jr., with its rugged body fabricated in one piece of polyester resin-fibrous glass laminate, was originally designed only for use as a promotional gimmick to be set up in dealers' display rooms beside the adult-size model. The reaction from dealers and customers alike, however, was so enthusiastic that the

Prototype of Kaiser-Darrin, Jr., was first sculptured in clay. Plaster molds cast from the prototype body were then used as the models for the two phenolic production dies

Courtesy Kaiser Motors Corp.

Courtesy Steiner Plastic Mfg. Co., Inc.

The molded one-piece body is then cured, sanded down, and sprayed with a prime coat of paint. Final coat of turquoise blue paint is applied at the assembly plant

Accurately scaled down to one-third the size of the actual Thunderbird, the junior version is 66 in. long and can seat two children. Battery-operated motor gives speeds up to 5 m.p.h.

Courtesy PowerCar Co.

manufacturers of the miniature car were encouraged to make it available as a consumer item.

Similarly, the Kaiser-Darrin, Jr., a coaster-type miniature auto with a streamlined body formed in two parts from rigid vinyl sheet and riveted together, was originally conceived as a prize to be awarded to the winners of a contest staged jointly by Kaiser-Willys and the Kaiser Aluminum Foil Co. But the aggressive advertising campaign which backed up the introduction of the Kaiser-Darrin, Jr., has stimulated the interest of toy manufacturers in the possibilities of adapting the sheet forming technique to the production of toy cars for the consumer market.

Quantity Production

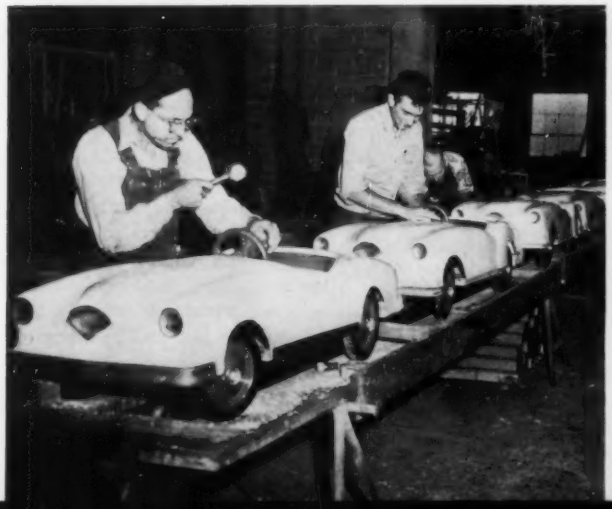
The Thunderbird, Jr., which is manufactured by PowerCar Co., Mystic, Conn., was styled by Ford's own design department to capture the racy appearance inherent in the adult-size model. Scaled down to one-third the size of the actual Thunderbird, the car is 66 in. long, stands 18¾ in. high, and is 34 in. wide—sufficiently large to accommodate children up to 5 ft. tall. It is powered by a Ford starter motor which provides speeds up to about 5 m.p.h. with a gear ratio affording more than ample power for climbing hills. The auto starts and stops when the driver presses a floorboard button with his foot.

Since styling represents such an important feature of the Thunderbird, Jr., the design potential and strength of polyester resin-fibrous glass laminate construction were basic reasons behind the selection of the material. The one-piece body is so strong, the child can sit or

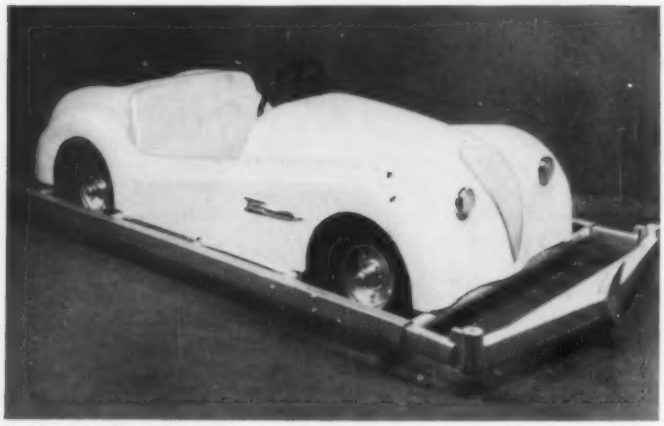
Front and rear halves of body are formed of vinyl on the two phenolic dies, riveted together, and screwed on to wood chassis frame

Side-by-side comparison between miniature auto and adult-size model shows authenticity of design in the rugged, lightweight vinyl body

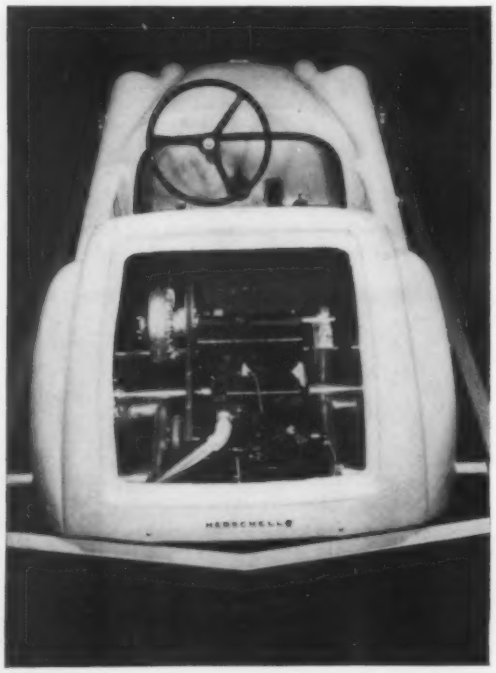
Photos courtesy Kaiser Motors Corp.



Strength of reinforced plastics miniature car body and the ease with which it can be repaired make it especially adaptable for amusement park "U-drive-it" concessions



Photos courtesy Atlas Plastics, Inc.



The stylish 50-lb. body of the "U-drive-it" auto is fabricated in one piece of polyester-fibrous glass laminate and securely bolted to the metal frame of the shock-absorbing chassis

Trunk lid of the car is molded separately of reinforced plastic and fastened with concealed hinges to the body. Before attaching the lid, the gasoline-driven motor is installed in the rear section of the car

even stand on the hood or tail of the unit without damaging it. In addition, the smoothly finished body will not rust and its light weight increases the amount of mileage per battery charge. The complete car, exclusive of the battery and motor, weighs 153 pounds.

Tooling up for the job was a relatively simple and speedy operation. Within six weeks after the plaster master mold was received by the fabricators of the part, completed bodies were rolling off the production line. At the present time, with five reinforced plastics tools being used, rate of production is about 45 units a week. This figure, however, is expected to be increased in the near future to approximately 50 units a week; some 600 units are already on order from the Power-Car Co. for Ford Motor Co. alone.

Bag Molding

The original plaster prototype of the Thunderbird, Jr., was cast under the direction of Ford's design department. From this was made the female production mold of reinforced plastics. Because a one-piece car body was the goal, yet many complicated undercuts were demanded, the mold is in three separate sections, each of which is further reinforced with metal in critical areas. When laying up the miniature body, these sections are assembled into a single set-up and mechanically clamped in place. A mold release agent, followed by a gel coat, is then sprayed into the assembled mold.

Lay-up of the polyester resin-impregnated fibrous glass mat is done manually. Several thicknesses of mat—the number varies according to the strength desired in a particular section—are placed in position with strips of 8-oz. burlap inserted between layers to add extra bulk to the finished wall sections.

A flexible polyvinyl alcohol bag is next laid up inside the mold. A pressure head is then swung into position over the mold and locked in place. Air pressure expands the P.V.A. bag against the laminate and the entire lay-up is rolled into an oven for a 1½-hr. cure.

After cure, the clamps holding the three-piece mold together are opened and the two end sections of

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FUNCTIONAL PLASTICS IN MUSIC SYSTEM

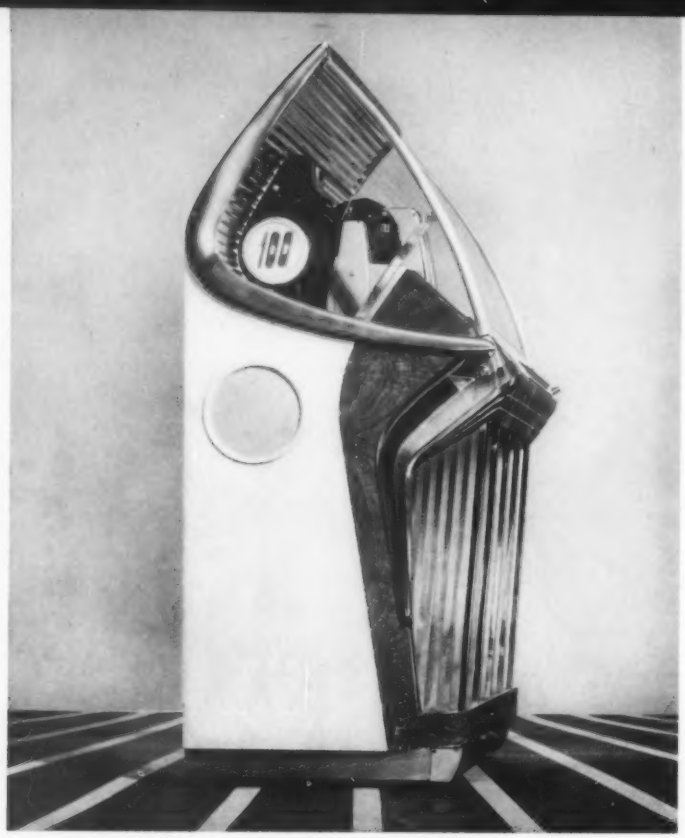
Phenolic gears, styrene housings, acrylic escutcheons, double-molded butyrate selector buttons, and printed rigid vinyl strips are used in latest automatic phonographs

Molded and fabricated plastics components, used for interior parts as well as for outside trim, play an important role in the modern design and efficient operation of automatic phonograph

AT LEAST seven types of plastics —general-purpose and medium-impact styrene, acrylic, cellulose acetate butyrate, rigid vinyl sheet, general-purpose phenolic, and cloth-base phenolic laminate—contribute to the modern design and dependable performance of the latest model Select-O-Matic "100" Music System, produced by J. P. Seeburg Corporation, Chicago, Ill.

While plastics for many years have played an important part in the construction of coin-operated automatic phonographs, most of these applications have been confined to decorative components of the cabinet, particularly where their color and translucency could contribute to the eye appeal and "action" of the instrument. Although the new Seeburg models make some use of plastics for this purpose, they also include several molded plastics parts which are particularly interesting in that they are closely associated with the actual record playing mechanism, and thus represent an important new type of outlet for plastics in automatic phonographs.

When introduced several years ago, the original Seeburg Select-O-Matic Music System was the first commercial unit designed to store and play records in a vertical position. By means of this ingenious arrangement, the compact mechanism can hold 100 45-r.p.m. records, making that many selections available to patrons at the drop of a coin. In addition to conserving space, vertical record storage minimizes the problem of dust settling in record grooves and also eliminates the customary stacking, with its resultant wear and tear on the disks. When selected, the records move forward into position on the vertical turn-



Molded styrene end bells and decorative caps follow contours of chamber that houses the playing mechanism; end caps can be illuminated by concealed light bulbs

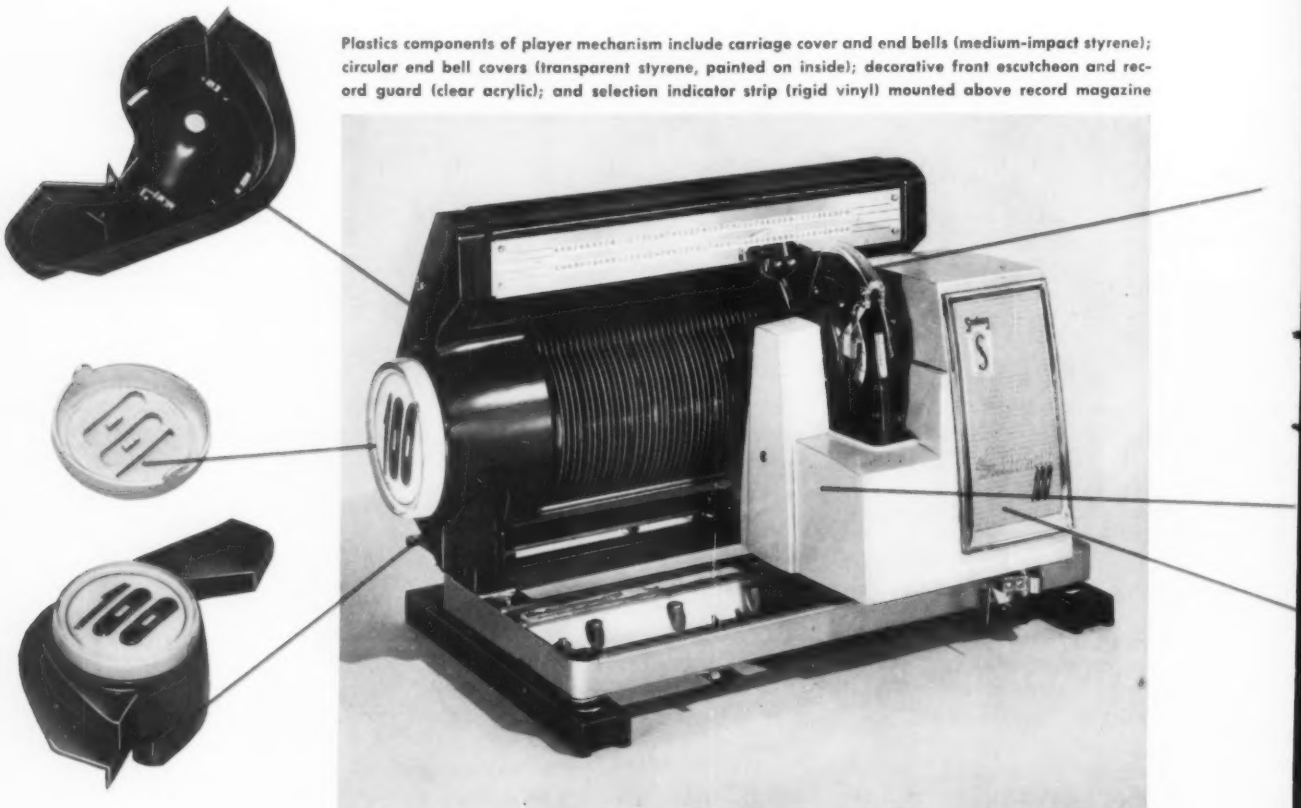
table and are returned to the rack after playing. The turntable assembly itself automatically moves into position in front of each record to be played.

Housings and Decorations

The three principal plastic parts of the Seeburg record playing mechanism include the carriage cover, which houses switches, wiring, and other elements of the unit, and the two end bells, which are essentially end covers for the record magazine rack. All three of these parts are injection molded of medium-impact styrene material. Until recently, the corresponding components, approximately similar in size and general design, were molded of black general-purpose phenolic material, painted to obtain the desired color. The modified design adopted when the changeover was made to thermoplastic parts also includes three new decorative components—a large acrylic escutcheon plate mounted on the front of the carriage cover, and two translucent styrene end caps, illuminated from the back, which snap into place on the end bells.

According to Seeburg cabinet en-

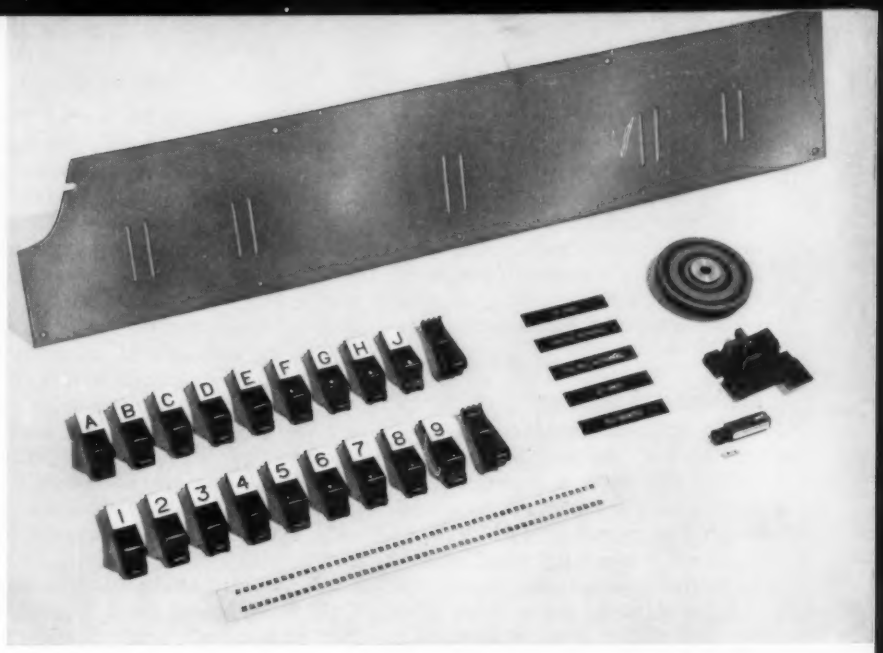
Plastics components of player mechanism include carriage cover and end bells (medium-impact styrene); circular end bell covers (transparent styrene, painted on inside); decorative front escutcheon and record guard (clear acrylic); and selection indicator strip (rigid vinyl) mounted above record magazine



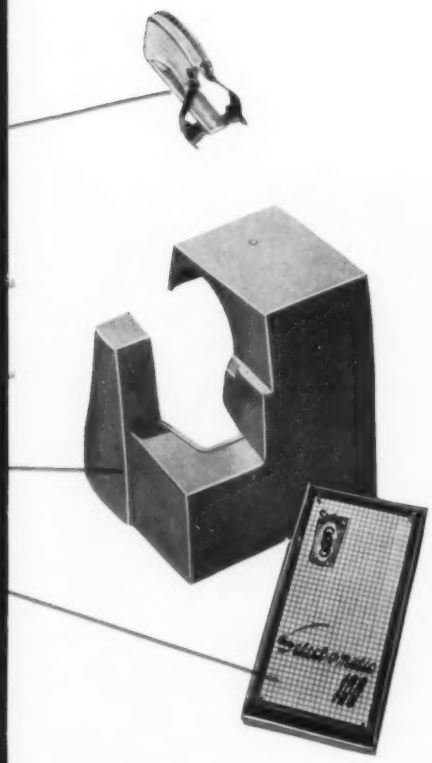
gineers, several important advantages were gained through adoption of the new thermoplastic parts. For example, the desired light and dark blue colors are now obtained without any supplementary finishing operation, whereas the previous parts were painted and either air dried or given a low-temperature bake. The inherent color of the injection molded parts has greater "depth" and eliminates the problem of painting rejects and frequent touch-up work. Cost-wise, including finishing costs of the earlier thermosetting components, the injection molded parts are approximately the same.

Curved Acrylic Escutcheons

In the previous Select-O-Matic model, the carriage cover was designed with a rectangular opening in the front. This aperture was covered by a translucent window of rigid vinyl sheeting imprinted with the words, "100 Select-O-Matic Mechanism," illuminated from within by means of a small light bulb. On the new model, this arrangement has been supplanted by a handsome rectangular escutcheon plate, with design details and lettering intaglio molded into the back side and vacuum plated in several colors. This part is injection molded of clear transparent acrylic material. Curved to correspond with the front side of the carriage cover, the escutcheon is secured to the cover by means of a screw at each corner.



Plastics parts of phonograph also include (top to bottom, left to right): light diffuser (styrene); selector buttons (butyrate); classification headings (rigid vinyl); pinion gear (canvas-phenolic); mounting blocks (phenolic); and selector strips (rigid vinyl)



In changing over to a thermoplastic material for the redesigned carriage cover and end bells, medium-impact styrene was specified because it seemed to offer an ideal combination of properties—integral color, moderate cost, ease of molding by the injection process, durability, and exceptional dimensional stability. The last point is particularly important since any tendency to warpage in these parts, while not affecting the actual operation of the phonograph, would spoil the attractive appearance of the mechanism, which is spotlighted within a glass-enclosed chamber.

Three Styrene Parts

Largest and heaviest of the three medium-impact styrene parts is the carriage cover. This component weighs 20 oz., measuring 9⅞ in. high, 9 in. wide across the front, and 7¾ in. deep. The cover is molded with one cored hole at the top, reinforced by means of an internal boss, which permits the cover to be mounted to the carriage by means of a bolt and wing nut. Further attachment is provided through another opening which is drilled through the left side of the piece. Four additional holes drilled through the front face of the cover are for attachment of the decorative escutcheon plate. This edge-gated part is produced on a 32-oz. injection machine, using a single-cavity die. The cover is designed with a large slot toward the left end of the part, in which the turntable rotates.

The end bells, weighing 9 oz. each, are produced in a two-cavity combination mold running on a 32-oz. injection machine. Maximum dimensions of these parts are 13¼ by 7 by 4 in. deep. They are made in left and right halves to fit the two ends of the record magazine assembly. Each of these parts has a saucer-like depression which serves as a housing for a concealed light bulb. These depressed sections, after molding, are spray painted white for increased light reflectance. Four slots around the periphery of the depression provide attachment for the translucent styrene disks or caps which are mounted to each end bell. Two cored holes through the side of the end bells accommodate assembly bolts which hold them in position at each end of the record magazine.

Two spring steel ribbons, held in position by thread-cutting screws on the inside surface of the end bells, make it possible to snap the

end disks in position or remove them quickly for bulb replacement. Projecting flanges molded on the edge of the end disks pass through two of the slots in the end bells and lock in position when rotated slightly to the right. The outward pressure of the two springs helps to provide a secure assembly between the two parts.

Masking and Spraying

The end disks, produced on a 9-oz. injection machine in a single-cavity die, have a maximum diameter of 5½ in. at the base and weigh just over 4 oz. each. Molded of clear transparent regular styrene, these parts carry the figure "100" molded in the reverse side, together with a series of horizontal ribs and a circular border. They are decorated in blue and a background white by a masking and spraying technique. When the concealed bulbs are lighted, illumination passing through the translucent end disks gives the record playing mechanism increased visual interest.

Outstanding from the molding and decorating standpoint is the decorative acrylic escutcheon which mounts on the front of the carriage cover. Injection molded of clear transparent material on a 16-oz. machine, this part is produced in a single-cavity die. Edge-gating on the underside eliminates any blemish at this point that might detract from the appearance of the finished part, which weighs 7½ ounces. The escutcheon plate measures approximately 4⅞ by 8¾ in. in size and has a maximum wall section of ¼ inch. This part presents a rather difficult molding problem because it is not flat, like most decorative name plates, but curved to match the contour of the front of the carriage cover. The part is held to accurate curvature by means of a cooling fixture, plus very close control over molding temperature and cycle. Vacuum plating of the details molded into the reverse side of the part is done in a combination of gold, silver, red, and a light metallic blue.

Also molded of clear acrylic material is the record guard. The function of this part, which closely resembles a circular saw guard in appearance, is to prevent possible dislocation of the records when they are shifted from the storage magazine into playing position. Mounted to the stripper plate of the turntable mechanism by means of two small bolts, the record guard has two spring metal extensions having small brushes at the end which clean off the needles (one on each side of the tone arm) each time a record is played. These diminutive brushes have molded plastic backs, designed with a groove which fits a slot in the spring metal supports.

The metal tone arm of the Select-O-Matic "100," spring-loaded to maintain correct pressure against the records as they play in a vertical position, terminates in a Pickering high-fidelity magnetic pickup encased in molded plastic. A feature of this pickup is a permanent cartridge with a quickly removable armature and stylus assembly, permitting the use of either diamond or sapphire tips. The tips are mounted on a small tapered plastic base which slides into grooves in the cartridge.

Hidden Phenolic Parts

Not visible in the final assembly are two phenolic parts which are very important in the operation of the automatic phonograph. One is a mounting block, compression molded of black general-purpose phenolic material; the other is a helical gear, 3½ in. in diameter, hobbed from cloth-base phenolic laminate stock.

The molded mounting block houses two small electric bulbs which light up a numbered strip above the record magazine, designating which selection is being played. The part, which contains recesses to accommodate the bulbs as well as numerous cores in all three planes for assembly purposes, was designed for plastic molding because a metal stamping would not have met the requirements satisfactorily and a die casting would have lacked the necessary electrical insulating properties. The molded

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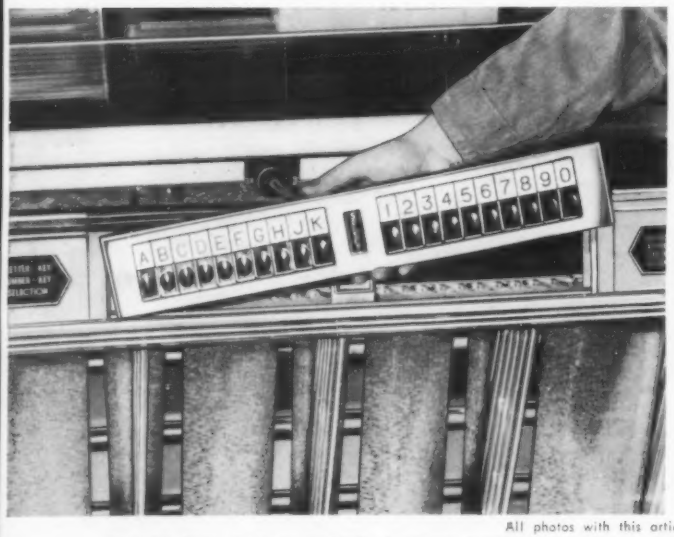

Selector keys, injection molded of acetate butyrate by a two-shot method, are mounted in two groups at front of phonograph system

Classification headings, at top of die-cast frames containing strips bearing names of available records, are printed on dark rigid vinyl

All photos with this article courtesy J. P. Seeburg Corp.

Era of Decision was keynote of management sessions at Annual S.P.I. Conference.

Papers on thermoplastic sheet forming were also featured

THE 1955 general conference of The Society of the Plastics Industry was well attended and most significant in material presented. The Conference itself occupied two days, Monday, May 9, and Friday, May 13, and was held during a cruise on the *Queen of Bermuda* to Havana and Nassau, May 7 to 15. Taking the theme "Era of Decision" and basing his premise on the fact that present-day standardized procedures in business and automation in industry make the actual operation of a business not too difficult a pattern but that the making of management decisions is becoming more and more difficult, Alan S. Cole, executive vice president of Breskin Publications, Inc., headed up the Program Committee under the Conference Chairmanship of Chris Groos, vice president, Boonton Molding Co.

As chairman of the Monday morning session, Mr. Cole introduced J. J. O'Connell, president of S.P.I., who welcomed the delegates to the conference. Chairman of the Monday afternoon session was Walter J. A. Connor, vice president, Celluplastic Corp.

A resumé of the addresses presented at both Monday sessions follows.

***The Climate of Decision*, by Grover Ensley, staff director, Joint Committee on the Economic Report, U. S. Congress.**

A review of our present national economy, of its recent course, and a projection of the effects of current trends for the next half decade proves the dynamic nature of this economy. Population growth trends, capital expenditure trends, consumer requirement trends, distribution trends, all point to greater markets in the future. Almost every index is upward—and the plastics industry is growing faster than any other.

Five years from now we'll have a population 12½ million greater than at present. We'll have more young people and more people over 65 years of age and proportionally fewer in the productive age group. At the same time, mechanization in industry will cut our annual working hours per worker by 200 hours. So the leisure factor becomes most important. The travel market, sports market, do-it-yourself market, are all on the upswing because of this population trend coupled with the increase in automation.

The standard of living should advance at a fast pace. Obsolescence in durable goods will be more rapid through improvements in mechanics and design.

The area of discretionary spending is similarly improving. Personal savings are high in relation to gross national product.

By sound and careful control of credit policies and of money in circulation the government can help to keep this economic climate healthy. But it is up to the individual businessman to assess his markets in relation to that climate and make his decisions for expansion, diversification, and concentration in line with that assessment.

***A World of Decision*, by A. W. Zelomek, economist; president, International Statistical Bureau, Inc.**

There is little chance of there being in the next ten years a one-world peace; and there is little chance of there being a one-world war. There are many indications that medium and small nations would prefer to "sit out the next one," although there may be continual localized skirmishing.

In this atmosphere the United States will have to maintain a strong defense facility, but even more important a strong national economy which is not dependent on defense expenditures. Such an economy involves a flexible control of the nation's whole fiscal structure, credit, and subsidies.

America's foreign trade—both imports and exports—must be increased. In some cases certain industries may be affected adversely for a time but careful planning should prevent any major dislocations. Foreign trade policy, as an instrument of international diplomacy, creates some of the most difficult problems industry will have to face in the next few years, and those who administer foreign trade policy must study very carefully the possible effects that policy might have on the economic structure of the domestic economy.

***Decision in the Markets*, by Arno Johnson, vice president in charge of merchandising and marketing, J. Walter Thompson Co.**

The rapid changes in the character of our markets can mean increased opportunities for those who have the vision and the knowledge to make the right decisions, and changes in the ultimate consumer market will also determine the trends in plastics.

There is a trend toward home and family life, reflected in the rapid increase in the number of families, the increase in the number of children under 10, the rapid increase in home ownership, the movement of population to the suburbs, and the resurgence of religious interest.

There have been startling changes in consumer expenditures in the last decade with travel, home ownership, private education, television, radio, records, gardening, reading, and con-

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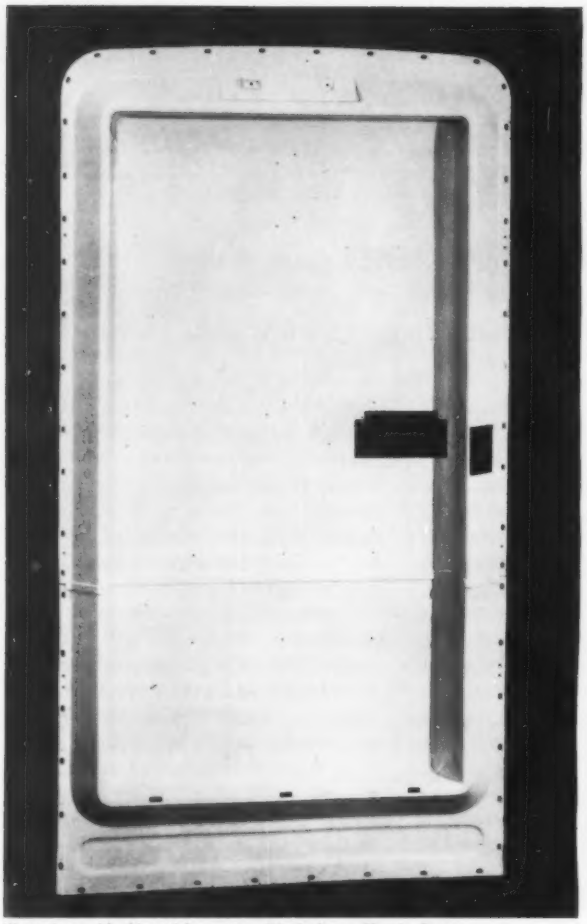

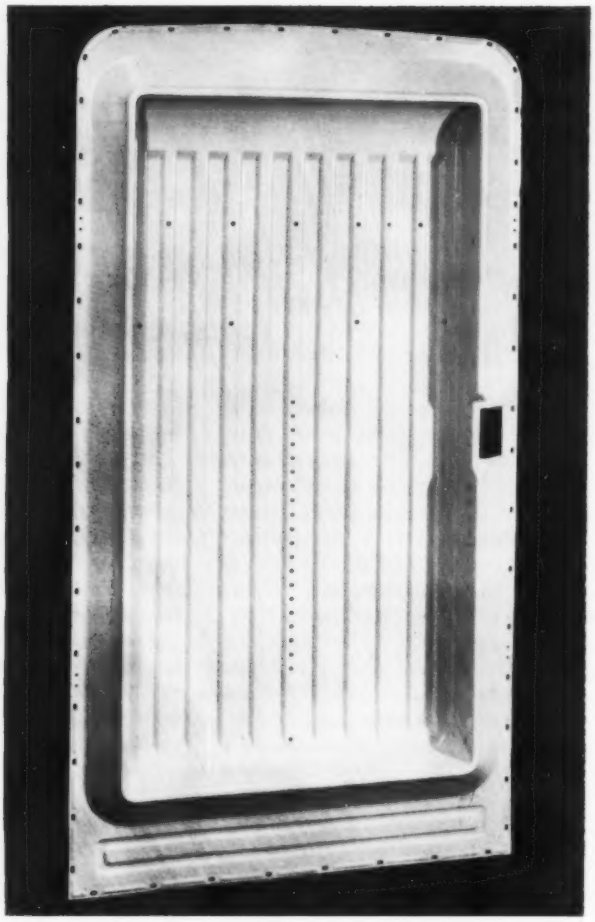

Illustrations with this article courtesy Westinghouse Electric Corp.

Fig. 1—Two-part injection molded panel weighs 9.25 lb., has an area of 13 sq. ft.; tool and panel cost are 100 arbitrary units each

Fig. 1A—Vacuum formed panel weighs 8.5 lb., has area of 13 sq. ft.; tool cost is 30 and panel cost is 89 equivalent arbitrary units

Form it...or Mold it?

An outline of the considerations involved in choosing a method for producing the most satisfactory plastics part at the lowest cost

by O. H. YOXSIMER*

IT IS estimated that over four million refrigerators will be produced in 1955 and it is predicted that by 1960 production of refrigerators and freezers will be at a rate of over six million annually. When one considers undeveloped world markets as well as population growth in developed areas, this prediction might well be on the conservative side. The greater portion of the inner door panels for these refrigerators are today made of polystyrene; with normal improvements in materials and in fabricating techniques, it is apparent that for the foreseeable future, polystyrene will continue to be used in such applications. Furthermore, additional and even larger area parts will be made of this or similar materials in the future.

Even at today's levels, the refrigerator inner door panel alone is a twelve million dollar business, and there is every reason to believe that fabrication of large area parts will be well over a one-hundred million dollar business within the next five years. Tremendous investments of private and corporate capital will be necessary to meet this market. It is, therefore, timely to compare the two methods that appear most likely to be employed in producing such parts—injection molding and vacuum forming.

This comparison will be confined

* Manager, Refrigerator-Freezer Engineering, Westinghouse Electric Corp.

to polystyrene refrigerator inner door panels (Figs. 1 and 1A); other large area parts bear enough similarity that the considerations will be generally applicable. The basic question to be answered is: "Which method will produce the most satisfactory part at the lowest cost?"

Trend Influences

Two factors that may influence the trend in the immediate future are: the very sizable investment that has already been made in injection molding equipment, and the fact that neither injection molding nor sheet forming has been developed to the stage that they may be considered to be sciences.

Presently, however, there is a period of confusion; vacuum forming is making inroads into the inner door panel business; those with not-quite-adequate injection molding machines are "digging in" for a showdown. Vacuum forming equipment has not yet been developed to much beyond the experimental stage; surface problems had to be solved before there was much need for "automation." But the time is at hand when decisions must be reached.

Evidence of this confusion is found in the recent quotations on five current model inner door panels listed in Table I. These quotations, piece costs expressed in arbitrary units, were obtained from seven reputable concerns, some of which quoted on both injection molding and vacuum forming of the pieces.

Since these panels were already in production, actual drawings and samples of the panels were submitted with the requests for quotation. It was stipulated that for the injection molded panels all sections should be 0.093 ±0.010 in. thick except for a ½ in. wide rim around the outer edge which was to be 0.125 in. thick; the vacuum formed panels were to be of 0.093 in. thick sheets with 0.040 in. minimum wall after forming. Only two of the molders submitted quotations on panels made to the thickness specified.

It is impossible to come to any conclusion from these figures. It was learned through check-backs with the suppliers that in all cases the injection presses figured for these panels had a maximum of 1500 tons clamping pressure. Further, that in all but two cases the vacuum forming was quoted on the basis of forming in present-day equipment.

This reveals two important facts: First, none of the injection equipment in use today has adequate clamping pressures to produce large-area parts in desired thicknesses; and second, except for low-activity items, most available vacuum forming facilities are not set up for high production of large-area items. It is, therefore, apparent that to answer the posed question, both methods

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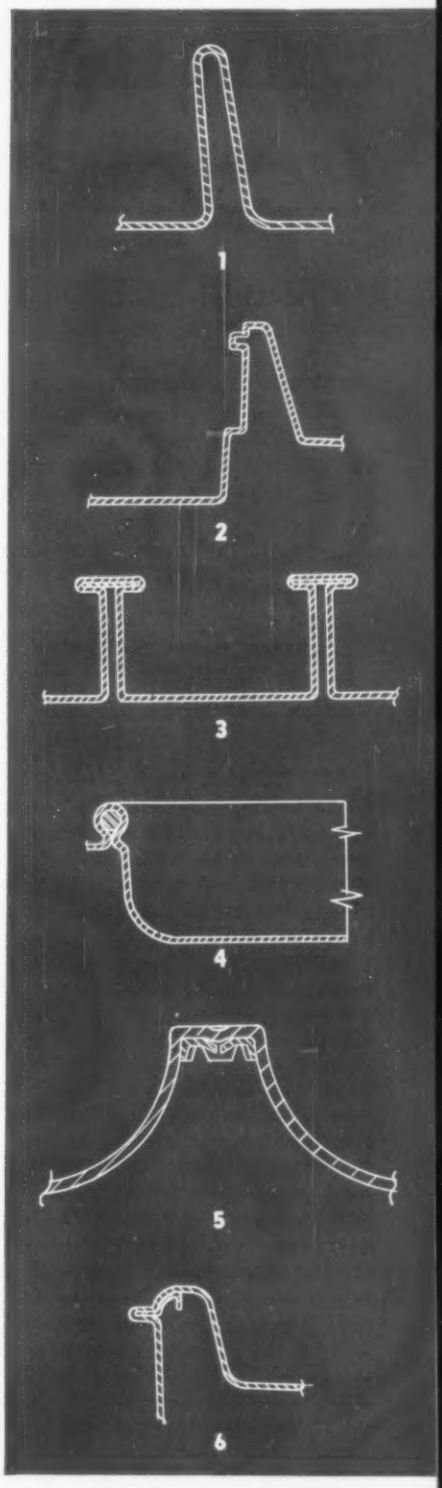
Table I—Cost Comparisons, Injection Molding Vs. Vacuum Forming

Molding Area	Capacity per 24 hr.		Tool Costs		Piece Costs	
	Inj.	Vac.	Inj.	Vac.	Inj.	Vac.
			$	$	[a]	[a]
1000 sq. in.	650	900	19,000	7100	100	74
1000 sq. in.	—	720	—	8600	—	84
1200 sq. in.	800	900	21,000	8950	100	67
1200 sq. in.	—	720	—	8900	—	77
1400 sq. in.	900	525	20,000	13,000	100	97
1400 sq. in.	—	720	—	9000	—	88
1700 sq. in.	500	720	28,000	9250	100	60
1700 sq. in.	—	900	—	8200	—	71
1900 sq. in.	600	525	31,000	16,900	100	90
1900 sq. in.	—	700	—	11,600	—	74

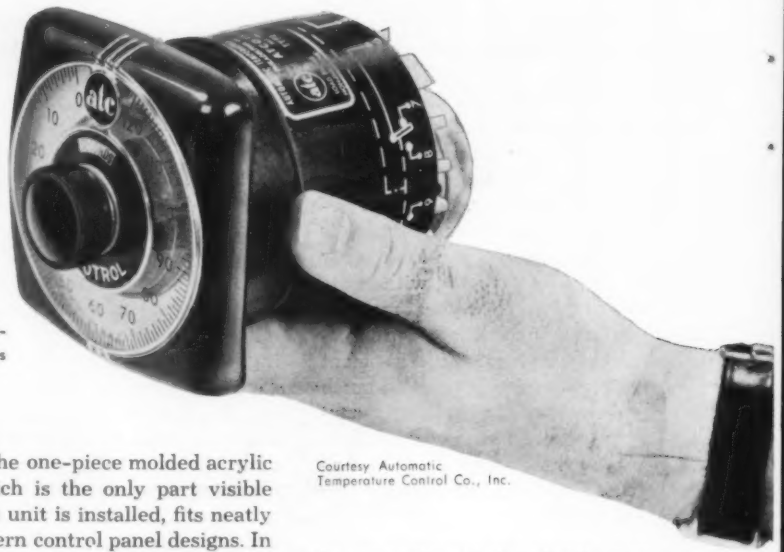
[a] Expressed in arbitrary units



Sketches 1 and 2 are diagrammatic representations of vacuum formed shapes which have been designed to compensate for weakness resulting from section reduction. Sketch 3 is a diagram of an "H" section with formed-in-place inserts. Sketches 4, 5, and 6 show other possibilities of inserts for panels made by vacuum forming

Smaller Timer–Better Timing

for industrial operations made possible by design incorporating seven major plastics components



Courtesy Automatic Temperature Control Co., Inc.

Compact construction of simplified, but accurate, miniaturized reset timer makes extensive use of plastics

DEPENDABLE, trouble-free performance under exacting modern industrial plant operating conditions is achieved by a new miniaturized dial-type reset timer which incorporates seven major plastics parts.

In designing the timer, which is a synchronous, motor-driven unit used for control of a.-c. or d.-c. loads within variable intervals or sequences, several basic objectives had to be met: compactness, a high degree of accuracy, ease of serviceability, attractive appearance, and flexibility of circuit arrangements. To accomplish each objective, while still keeping costs within a competitive range, Automatic Temperature Control Co., Inc., Philadelphia, Pa., manufacturer of the timer, emphasized the proper selection of materials to meet specific engineering requirements. And for seven of the Atcotrol 305 timer's most important parts, including the dial face, the housing, and the terminal block, plastics, in competition with other materials, won out.

The specific role which each of these seven parts plays in the performance of the timer dictated the selection of a different plastic material for each. (See chart, facing page.)

Fastened to the front of the timer chassis, the one-piece molded acrylic face, which is the only part visible when the unit is installed, fits neatly into modern control panel designs. In order to prevent the clean lines of the acrylic face from being marred by protruding screws, the part is designed so that the timer chassis can be fastened to it quickly and easily from the rear. Four cylindrical pockets are molded into each corner of the back of the dial face. Four rubber sleeves protruding from the front flange of the chassis are then inserted into the pockets. Two turns of the screws on which the rubber sleeves are mounted are sufficient to expand the sleeves against the walls of the pockets and lock the dial face securely in place. The dial face can be just as easily detached when it has to be changed to accommodate a different time scale. By using the same chassis body and simply changing the dial face and timing motor, timing sequences from 15 sec. to 240 min. can be achieved.

All decorative finishing on the face is also done from the rear. The bezel rings of the dial face are first vacuum metallized; maroon paint is then sprayed on the back side to form a decorative outer ring; finally, the dial calibrations are hot stamped on the rear surface of the face.

Since the timer is designed so that the operation of the clutch, motor, load contact actuator, elapsed time indicator, and time interval setting, can be visually checked through the dial face, a high degree of visibility was necessary. Transparent acrylic with its smooth, non-dust-collecting, easy-to-clean surface proved to be ideal. The dial face is molded with a curved front to provide a lens effect for maximum illumination. A highly reflective, white vinyl sheet, installed directly behind the transparent face, increases visibility. The flexible vinyl sheet, with die cut holes, is mounted on the chassis body front flange plate beneath the expandable rubber sleeve fasteners and doubles as a gasket between dial face and flange plate.

Housing and Terminal Block

For reasons of compactness, the timer chassis body is designed in a cylindrical shape that permits it to be easily mounted in a $3\frac{3}{16}$-in. diameter cut-out—and just as easily removed for servicing.

As protection for the chassis body against environmental conditions, a one-piece tubular phenolic-impregnated paper laminate housing is

slipped over the body. A cellular neoprene gasket behind the front plate provides a dustproof seal between housing and front plate while a neoprene O-ring in a groove between the laminate tube and the inside peripheral edge of the rear terminal block holds the housing in place. To remove the housing, this O-ring is simply pulled out of the groove by a vinyl tab.

A key slot cut into the front of the housing automatically positions the part against the front plate; a schematic wiring diagram, printed in white on the black surface of the laminate, simplifies circuit assembly and prevents errors in terminal point identification.

To the rear of the housing is the compression molded fibrous glass-reinforced alkyd terminal block. Like the acrylic front cover and the

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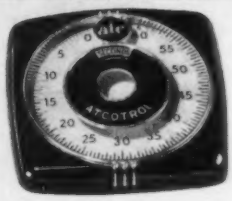
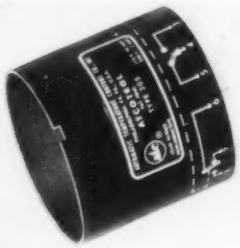
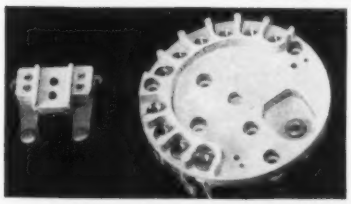
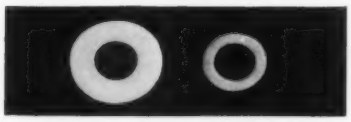
USE OF PLASTICS IN COMPACT INDUSTRIAL TIMER

	Item	Material Selected	Reasons for Selection	Supplier
	1) Front plate dial	Acrylic (Plexiglas)	Smooth surface; transparency; "lensic" effect; design and finishing potential; dimensional stability; corrosion resistance; light weight; impact resistance	Erie Resistor Co., Erie, Pa.
	2) Front plate gaskets	Vinyl	Bright white (good reflector); impervious to dampness, dust, and dirt; semi-compressibility for use as a pressured gasket; smooth finish; easy to clean; light weight	Philadelphia Gasket & Mfg. Co., Philadelphia, Pa.
	3) Housing	Phenolic-impregnated paper laminate	Impact resistance; insulating properties; low cost; impervious to most gases, etc; resistance to heat; non-splintering	National Vulcanized Fibre Co., Wilmington, Del.
	4) Terminal block and relay contact block	Fibrous glass-reinforced alkyd (Plaskon alkyd 440A)	Insulating qualities; low hygroscopic index; machinability; moldability; impact resistance; dimensional stability	Watertown Mfg. Co., Watertown, Conn.
	5) Knob	Phenolic (Bakelite)	Low cost (no machining is necessary); color potential; toughness; good grip on knurled surface	Watertown Mfg. Co., Watertown, Conn.
	6) Friction washers	Teflon	Self-lubrication; flexibility; compressibility; insulation qualities; shock absorption; moldability	United States Gasket Co., Camden, N. J.
	7) Set pointer torque tube	Nylon	Durability; flexibility under torsion; impact absorbing qualities; adaptability to large-volume production; resistance to corrosion	Watertown Mfg. Co., Watertown, Conn.

NOW: MOLDED-IN DECORATION

Special "foils," lithographed in any design in any number of colors, form an integral part of the finished molded piece

A PRACTICAL and economical method of molding multi-color decorative patterns into the surface of melamine tableware and other items made from melamine and urea molding materials has recently been placed in mass production by several molders.

This plastic decorating process is the development of Einson-Freeman Co., Inc., and involves the use of a "foil" of specially made paper-like material, lithographed with the desired design in any number of colors of special inks, and impregnated with melamine resin. The "foil," which is delivered to the molder's plant die-cut to the shape and size required, is inserted face down in the mold, generally during the breathing or de-gassing phase of the cycle, where it cures into the molded dish under the surface of the molding material and, in this manner, becomes an integral part of the finished product.

Depth of Draw

"Foil" decorations may be made in any size or shape, up to and including sheets 50 by 69 in. for flat laminate decoration. If existing molds are simple in contour, they frequently may be used with the new decorating material, but in certain cases modifications have been found necessary. Limited draws up to three-to-one ratio (a "foil" disk 3 in. wide will draw to an inch in depth) are possible because of the stretchability of the material. A new method for decorating deep drawn dishes is now being tested on a production basis, but for the present spot decoration is the general rule in such cases.

In the molding process, the "foil" itself literally disappears—the paper-like material being colorless—leaving only a rich gloss on the plate. The design is in the plate and the color of the molding powder comes through on open or non-decorated areas as a part of the final design. Very dark colors of molding material are not recommended.

Basically the same rules should be followed in storing and caring for the "foils" as are followed in the care of the molding material. Relative humidities above 40% should be strictly avoided and storage temperatures should not be above 75° F. The die-cut "foils" are packed 200 to a sealed polyethylene bag for protection in transit and after arrival. Prevention of contamination in the molding plant is most important for best decorative results.

Melamine dinnerware molded by Plastics Mfg. Co., has colorful molded-in design achieved through use of lithographed "foil"

Four-color plates courtesy American Cyanamid Co.

FOR COLORED THERMOSETS

The cost of the "foils" varies with the complication of the design, the color, the size, and the quantity. An increase in molding time cycle must be considered in costing a finished decorated item, that increase varying from 5% up since an additional step is being taken in the molding process. Each molder's product is exclusive in pattern and color design.

Types of decoration are absolutely unlimited in this process. Reproduction may be from decals previously used for ceramic dinnerware, or lithographic art subjects such as prints, wood grains, club crests, trademarks; in fact any subject suitable for lithography is suitable for use in this type of decoration.

Dinnerware decorated by this plastic decorating process has been in continuous service on a test basis for three years and has stood up wonderfully. The Good Housekeeping Institute has had some under accelerated tests for three months and has given its approval and seal to products thus made.

Present and Future Use

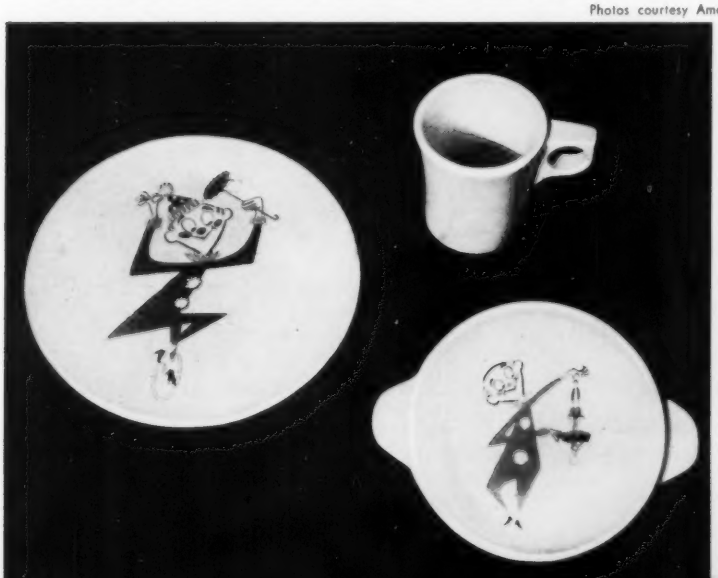
Already Plastics Manufacturing Co., Dallas, Texas, is marketing three decorated patterns in household dinnerware and three in commercial or restaurant dinnerware. International Molded Plastics, Inc., Cleveland, Ohio, has on the market

Courtesy Einson-Freeman Co., Inc.

Artist's conception of possible applications for the new thermoset decorating process include door knob and escutcheon, lipstick cases, gift boxes and other containers, closures, and wall tile

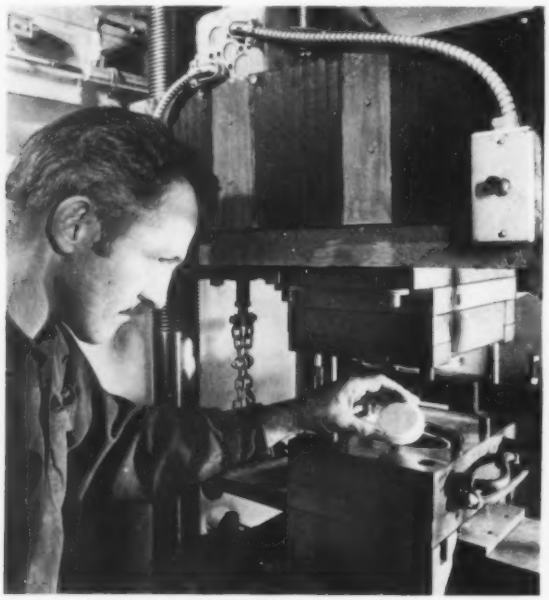
Dinnerware set for children (cereal dish, saucer, and milk mug) is decorated with colorful clown design. Molded of melamine by International Molded Plastics, Inc., the set combines attractive appearance with break resistance and functionality

Photos courtesy American Cyanamid Co.

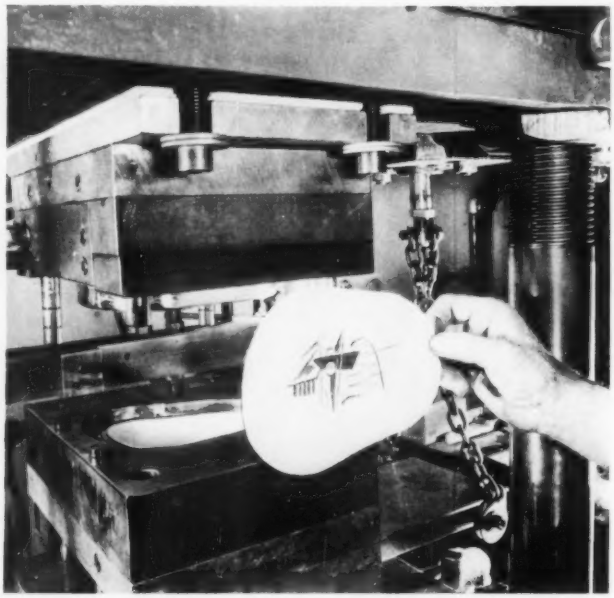


a child's set of plate, cup, and bowl. Both these companies are preparing to go into mass production on additional lines. A large chinaware maker is entering the field. A nationally known watch manufacturing company is tooling up for melamine gift boxes with molded-in decoration. A California company is working on a variety of moldings including decorated cabinet knobs. An Eastern molder is presently working on radio cabinets with molded-in decoration.

In all, Einson-Freeman Co. is currently producing 17 designs of dinnerware "foils" and is in sketch stage on a wide variety of other items including urea packaging for cosmetics, gift boxes, laminates, and various household items.

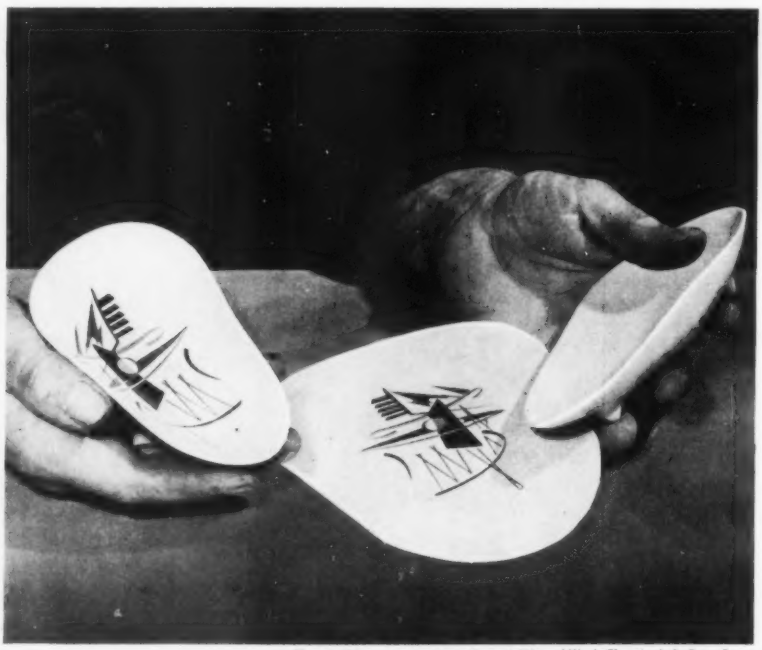


Photos taken in plant of Saxe Bros., Inc., show steps in molding decorated thermosets. Above, melamine preform is placed into mold



Lithographed foil is inserted in mold during the de-gassing phase of molding cycle, cures into molded piece under surface of the molding material

Operator removes decorated molded piece from press; flash is trimmed off later



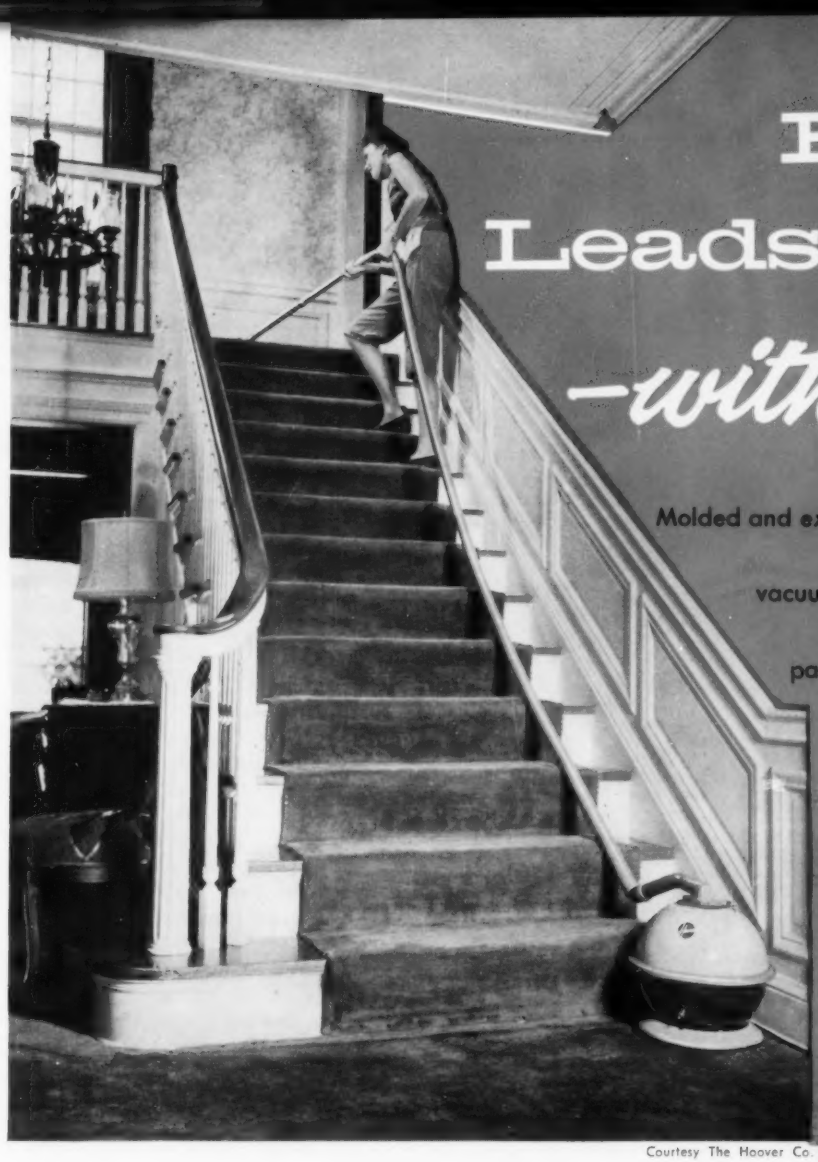
Photos this page courtesy Barrett Div., Allied Chemical & Dye Corp.

Finished decorated molding is at left; in center is one sheet of lithographed decorative foil; a molded but undecorated piece (same shape as piece at left) is shown at right

Hoover Leads Again —with Plastics

Molded and extruded vinyl components in new vacuum cleaner—plus other plastics parts—improve both performance and appearance

by F. A. MARTIN*



Improved extensibility and flexibility of extruded vinyl hose for new vacuum cleaner (so flexible it can be tied in a square knot, below) enable housewife to clean a full flight of stairs (left) without moving the cleaner

Courtesy The Hoover Co.

TWELVE molded and extruded vinyl components—many of them firsts in the vacuum cleaner field—make up the major share of the plastics parts going into the construction of the new canister-type Hoover Model 82 "Constellation."

Of the 2.754 lb. of plastics used to improve the performance and heighten the attractiveness of the Constellation, vinyl accounts for 2.097 lb.—a record high among the cleaners being put out by The Hoover Co., North Canton, Ohio. The remaining poundage is divided between cellulose acetate and/or cellulose acetate butyrate (0.345 lb.), phenolic (0.096 lb.), polyethylene (0.035 lb.), and styrene (0.001 lb.)

From the standpoint of over-all performance, the vinyl parts have proved superior in many respects to rubber. The aging of vinyl is better than that of rubber and surface cracking is virtually non-existent in a properly formulated vinyl compound. The color potential of vinyl and the high-gloss finish of the molded or extruded part also contribute much to the appearance of the vacuum cleaner and, in many of the applications, the abrasion resistance of vinyl is often better.

Although the initial cost of vinyl is higher than that of rubber, the ease of moldability of vinyl and the rapid molding and extrusion cycles possible have in many cases lowered the cost of finished vinyl pieces below that of rubber ones.

One of the most important of the

* Section Head, Plastics Laboratory, The Hoover Co.

Extruded vinyl furniture guard (arrows) with hollow inner section doubles as a gasket around the joint where the two hemispherical halves of the cleaner meet

Vinyl nozzles are molded with undercuts that facilitate snap-in assembly of brush bristles and tubes

Litter pickers (arrows), also molded of vinyl, are inserted in rug (top) and furniture (bottom) nozzles to improve cleaning efficiency by 10 percent

12 vinyl parts in the Constellation is the "Ultraflex" hose.

Extruded of dry-blend vinyl compound in blue-grey to match the color of the metal cleaner housing, the new hose is claimed to provide greater flexibility and extensibility than any of the other types previously used by Hoover. The vinyl hose is attached to the 360-degree swivel top of the spherical housing and can easily stretch from its normal free length of 6 ft. to an in-use length of 13 ft. without tearing. The housewife can thus clean a full flight of stairs or a room area of about 750 sq. ft., without having to move the cleaner. Because of its flexibility and stretchability, the user can also clean around corners and behind and underneath furniture without trouble.

The hose is reinforced with a spring steel wire which is coated with a vinyl compound to cushion the relatively thin wall tubing which forms the hose body from abrasion on the wire and to anchor the spring coils in position in the cover tubing. To conceal the joint between the hose body and the metal end fittings, an injection molded vinyl grip is used.

Two other small vinyl parts go into the hose: an extruded latch cover and a molded gasket which fits inside the attachment tool end to seal against suction leaks. The suction regulator button on the top side of the hose end is molded of cellulose acetate butyrate.

In two of the cleaning tools with which the unit is equipped—the rug nozzle and the furniture nozzle—

Photos both pages courtesy The Hoover Co.

Telescoping extension tube (right) incorporates three basic plastics parts (left, top to bottom): molded vinyl gasket which seals against suction leaks; extruded latch cover; and a molded high-impact styrene guide inserted between the inner and outer tubes

molded vinyl brush-like elements, which are referred to as litter pickers, are used.

Litter Pickers

One of these litter pickers, consisting of a long strip of vinyl with a row of projecting flexible vinyl fingers, is installed inside the front lip of the rug nozzle. The function of the fingers is to separate the carpet as it is being cleaned and to comb hair and threads free from the pile so that they can easily be removed by suction from the cleaner. By separating the pile tufts, the litter picker also facilitates the removal of deeply embedded dirt. Cleaning efficiency tests show a 10% improvement in effectiveness attributable to this vinyl part.

On former models, similar litter pickers molded of neoprene were used. Vinyl was selected for the application in the new model after comparative abrasion tests showed it had superior wear resistance. As an added incentive, the molded vinyl part costs less than half the neoprene molding.

The litter picker used in the furniture nozzle operates on the same principle as the one in the rug nozzle only it is in appearance and action more like a conventional bristled brush. The litter picker is molded with three rows of fingers, each finger approximately $\frac{3}{8}$ in. long by $\frac{1}{16}$ in. in diameter. The rows are staggered, so that clearance between adjacent fingers is approximately 0.010 inch. The major advantage of the vinyl picker, in addition to its effectiveness in removing hair and lint from fabrics, is the ability of the flexible fingers to shake off the bits of hair and lint as they are being sucked up into the cleaner. The conventional tufted bristle brushes previously used would fill up with fluff after being in service for a short while, would clog up and impair performance, and were most displeasing in appearance.

Furniture Guards

An extruded vinyl strip is installed around the circumference of the spherical housing at the point where the two hemispherical halves are joined together. The flexible strip is extruded in an attractive ribbed profile that accents the modern styling of the cleaner and is rugged enough to serve as a protective guard in case the cleaner should be accidentally bumped into a piece of furniture. The inner section of the extrusion forms a gasket that prevents suction leaks at the point where the two shell halves are joined. The center of the raised strip is hollow so that when the ends of the guard are joined together around the housing, the entire strip forms an effective air-cushion seal.

The 60-Durometer stock from which the guard is extruded is formulated especially for low permanent set and to prevent staining or softening of the enamel on the housing shell.

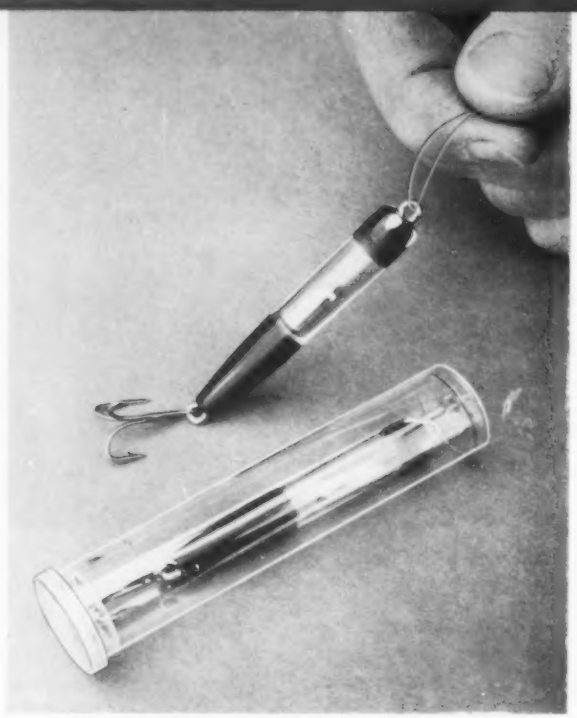
Protective Sheaths

Two other major applications for molded vinyl parts are in the protective sheaths for the floor brush and dusting brush nozzles. In both cases, the sheaths are molded with undercuts designed to retain the brush backs and swivel attachment tubes that are snapped into place in the sheaths.

Similar parts on other Hoover models had previously been made in rubber, but vinyl was found to offer better finish, better color possibilities, and better abrasion resistance.

(*To page* 204)

PLASTICS



Live Action Fishing Lure

The shifting weight of a small quantity of mercury that partially fills the hollow body of a molded cellulose acetate butyrate fishing lure causes it to wiggle, dive, jump and dart continuously as it is retrieved. Exceptionally tough and corrosion resistant, the butyrate lure, called Mercury Worm is just the right weight (3/8 oz.) for casting, spinning or trolling. It will run deep with a slow retrieve and 6 to 8 in. below the surface with a fast retrieve or while trolling. The lure, with the treble hook removed, can be used for practice casting without fear of damaging it.

The Mercury Worm lure is produced in two parts on a 6-oz. injection molding machine using an eight-cavity mold to produce four bodies and four tops. After molding, the mercury is dropped into the hollow body and the head and body are joined with solvent cement. Metal eyelets inserted in both ends serve as a means of attaching leader and treble hook. Colored areas are lacquer coated.

CREDITS: Molded by Rampe Mfg. Co., 3320 St. Clair Ave., Cleveland, Ohio for K-L Co., Angola, Ind. Cellulose acetate butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

Adjustable Flow Dispenser

Designed primarily for serving and storing ketchup, mustard, honey, or other materials of similar viscosity, this three-piece flexible polyethylene dispenser can be readily converted for dispensing relishes, jam, and sugar. The cone-shaped design of the positive snap-on nozzle cap permits the user to cut off the tip of the nozzle to the proper size hole (from 3/32 to 3/8 in.) to accommodate various materials. An additional air-seal cap friction-fits over the nozzle to completely close the dispenser to prevent evaporation and spilling. By removing the nozzle cap, the wide-mouth container can be easily filled or cleaned. The possibility of upsetting the container is reduced because of its wide base. With a capacity of 9 oz., the easy-to-grip squeezable dispenser will also find use outside the kitchen for oil, glue, grease, etc.

Injection molded of polyethylene, the dispenser can be obtained in a wide variety of colors with white tops.

CREDITS: Manufactured by Columbus Plastic Products, Inc., 1625 West Mound St., Columbus, Ohio. Polyethylene supplied by Bakelite Co., New York, N. Y.

PRODUCTS

Free-Flowing Can Caps

Called Stein-Kap, a snap-on cap for beverage cans, molded of polyethylene, provides a sanitary and convenient method of pouring or drinking beverages directly from the can. The re-usable cap is easily pressed over the can—either 12- or 16-oz. size—after the latter has been punctured with the two regular holes. A molded-in flange which circles the inside lip of the cap rides over the beaded rim of the can to form a liquid-tight seal which prevents the liquid from flowing down the side. The drinking spout extends above the level of the cap to fit the mouth comfortably. A small breather hole in the cap allows air to enter the container freely, thus permitting the contents to pour smoothly. The polyethylene Stein-Kap can be cleaned in hot soapy water and is odorless and tastless.

Stein-Kaps are molded on an 8-oz. injection molding machine using a 14-cavity mold. Available in eight different colors, the caps are packaged three or eight assorted in a cellophane bag.

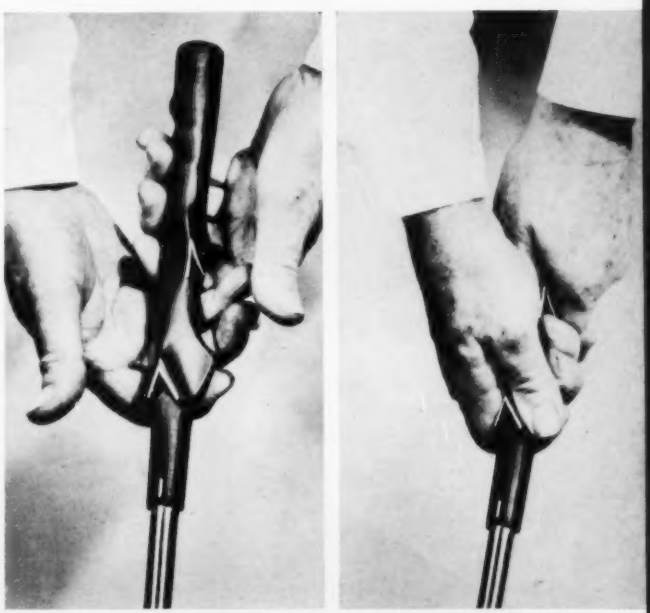
CREDITS: Manufactured by Berkshire Plastics Co., Inc., 147 Shaker Rd., E. Longmeadow, Mass. Polyethylene supplied by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Vinyl Golf Club Grip

Molded to the shape which the hands assume when properly placed on a golf club for the best swing, the V-V Golf Grip, injection molded of vinyl, will save the novice golfer time and effort in acquiring correct hand positioning. Two V-shaped markings sharply outlined on the grip indicate exact positions for thumb and forefinger of each hand with the "V's" pointing into the groove between the fingers. The remaining fingers then fall naturally into place in ridged grooves that circle the molded handle for either the overlapping or interlocking type of grip.

Because of the flexibility of vinyl, the golf grip can be stretched-fitted over any conventional golf club and will transmit full hand pressure to the swing of the club without any danger of slipping or coming loose. The grip is available in men's, ladies', and junior sizes and will effectively resist the corrosive action of perspiration, moisture, mould, mildew, and rust.

CREDITS: Molded by Hungerford Plastics Corp., Rockaway, N. J., for The Kroydon Co., Burnett Ave. and Rutgers St., Maplewood, N. J. Vinyl by Bakelite Co., New York, N. Y.



PLASTICS ENGINEERING*
F. B. Stanley, Engineering Editor

Where and How to Use Epoxies

Practical details on applications of these resins in coatings, adhesives, castings, moldings, and foams

by JEROME FORMO† and LUTHER BOLSTAD‡

EPOXY resins were early used as plasticizers for other plastic materials. Now, however, the largest single use for these versatile materials is as film formers in surface-coating formulations. Excellent chemical resistance coupled with very superior adhesion to metals has given these materials an important position in the coatings field. Color retention is good and it is possible to formulate coatings in light colors. The inherent flexibility and toughness of the film structure makes these coatings vastly superior to any other thermosetting resins for applications where the base material may be subjected to bending, twisting, and bumping. The excellent adhesion of epoxies makes lifting almost nonexistent, the direct-addition type of polymerization makes blistering improbable, and their chemical inertness prevents the easy development of surface imperfections.

The peculiar surface-tension characteristic of the liquid resins made pinholing a severe problem at first. The solvent resistance of the polymerized resin made solvent systems and clean-up procedures very difficult. Since the initial problems of formulating paints and enamels from these resins have been solved, however, the uses for these superior paints have expanded to cover all quality merchandise from floors to refrigerators. White enamels can now be formulated which not only are resistant to fruit juices, lipstick stains, and harsh alkali cleansers, but which will also remain white when exposed to direct sunlight.

Display of abrasion resistance in our epoxy coatings has also been dramatic. A sample panel sent to the laboratory for a dropping sand abrasion test was returned without signs of wear; yet a liter of sand had been dropped (Fig. 1) from the top of the dropping funnel 200 times. In almost any other standard test, when paints based on epoxy resins are evaluated, we discover new heights of durability. The results of dropping-ball impact tests (Fig. 2) show that new extremes of testing stress are necessary.

A typical formulation of an epoxy coating at Honeywell is shown in Table I. The first three ingredients form a stable solution and can be stored as such. The amine hardener is added just before use. The use-

Fig. 1—Abrasion resistance of epoxy coating was tested by dropping liter of sand through dropping funnel onto sample specimen 200 times. No sign of wear was noted at end of test

Fig. 2—Impact strength of epoxy coating was tested by the dropping-ball method. Results of test indicated need for extreme testing stress in order to produce failure in the sample

* Reg. U. S. Pat. Off.
† Director of plastics research and ‡ Supervisor of research and development, Plastics Laboratory, Minneapolis-Honeywell Regulator Co.
This article was adapted from a paper presented at the Eleventh National Technical Conference of The Society of Plastics Engineers, Inc.

Table I—A Typical Honeywell Formulation of an Epoxy Coating

Epon 101[1] 50% in methylisobutyl ketone, Cellosolve, and toluene (45:5:50)	160 PARTS
Thiokol LP-3[2] 50% in methylisobutyl ketone, Cellosolve, and toluene (45:5:50)	40 PARTS
Formvar 15/95[3] 10% in ethanol and toluene (3:7)	50 PARTS
3-diethylaminopropylamine[4]	4.8 PARTS

[1] Shell Chemical Corp. [2] Thiokol Chemical Corp. [3] Shawinigan Products Corp. [4] American Cyanamid Co.

ful life of the coating solution after addition of the hardener is less than one day. Although reasonably good properties are obtained with a room-temperature cure, the coating is improved considerably by baking at 200° F. for 1½ hours.

Adhesives

Another very important and rapidly growing use for epoxy resins is in the field of adhesives. The highly desirable surface activity of the resins when in the liquid state makes it possible for them to wet the surface of many different materials including steel, aluminum, brass, plastics, glass, wood, and almost all rigid materials. Tensile bond strengths of over 12,500 p.s.i. are exhibited when bonding steel to steel and over 8700 p.s.i. when bonding aluminum to aluminum. In fact, it has been found that epoxy bonding of aluminum can show about twice the bond strength and many times the reliability found when using a soldering method.

In proving the case for bonding aluminum, we ran into the type of engineering inertia that is so frequently met when plastics are suggested as a possible solution to design problems. The problem which brought the case to a head involved the bonding of nine glass-to-metal hermetic seals into an aluminum ring (see Fig, 3). With soldering, incidence of cracking of the glass seals was about 10 percent. And yet, when an epoxy adhesive was suggested, it was considered heresy to think that there was a better adhesive than solder. We prepared equal numbers of solder- and epoxy-bonded specimens of the same shape and size for tensile tests. The test results were dramatic. Not only was the average strength of the epoxy bond double that of the best soldered joint, but the values were very uniform. It was found that several of the soldered joints were less than half bonded. The superior wetting ability of the epoxy resins improved the reliability of the bonded joints many times. The switch to epoxy was begun. After that we actually had to police the Engineering Departments, since the most unorthodox uses for epoxy ad-

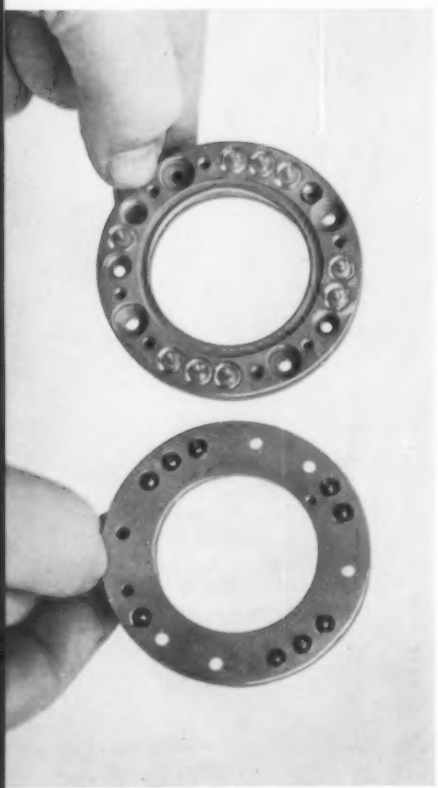


Fig. 3—Epoxy adhesive proved superior to solder in bonding to aluminum

Table II—Several Adhesive-Adherend Systems

Formulation	Parts	Average bond strength: Steel	Brass	Aluminum	Bond area
Epoxy resin	100	720	1400	1570	2 sq. in.
Hardener 1	25				
Epoxy resin	100	1500	1950		2 sq. in.
Hardener 1	25				
Filler	35				
Epoxy resin	100	1750	2650	4500	0.443 sq. in.
Hardener 2	5				
Epoxy resin	100	2050	3025	4750	0.443 sq. in.
Hardener 2	5				
Filler	90				
Epoxy resin	100	2400	4500	5400	0.443 sq. in.
Resin Modifier	5				
Hardener 2	5				
Filler	90				

Epoxy resin = BRR 18795 } Bakelite Co.
Hardener 1 = BRR 18793 }
Hardener 2 = Pyrrolidine — E. I. duPont de Nemours & Co.
Resin modifier = Polyvinyl Acetal — Shawinigan Co.
Filler = Titanox TG — Titanium Alloy Mfg. Co.

hesives were being tried, and some of them were not so good.

In the development of adhesives it was soon found that the hardener used in any epoxy system was very important. Table II lists the bond strength of several adhesive systems when used to bond steel, aluminum, and brass. Pyrrolidine, for example, helped to produce a material of very high bonding strength. Another hardener (methylene dianiline) produced bonds of such low strength that it could not be considered for use as an adhesive at all. This was important since one of the problems in converting epoxy resins to molding compounds had been adhesion to the steel molds.

We also discovered that certain minerals such as titanium dioxide added enormously to the bond strength, and that resins such as polyvinyl acetal increased tack for higher peel strength. Some adhesives have been developed which are available in stick form to be applied to a hot surface which first melts it and then cures it. Others are available as viscous liquids which can be used between large sheets of nonporous materials because curing does not produce volatile by-products. Most adhesive formulations are rather good electrical insulators, but electrically conductive adhesives have been made which can effectively be used in electronic circuitry to make ground connections between bonded metal components.

Casting

Most of the casting and encapsulation requirements encountered at Minneapolis-Honeywell may be resolved as follows: 1) Products must have good electrical properties, particularly high insulation resistance under extreme relative humidity changes and fairly wide temperature changes. 2) Delicate components such as glass tubes must not be damaged during cycling from −85 to 165° F. 3) Product must have good dimensional stability under service conditions. 4) Good solvent resistance is required in some applications. 5) Resin must have good handling characteristics such as pourable viscosity, low toxicity, pot life of ½ hr. or more, and reasonable curing rates at moderate temperatures (room temperature to 200° F.).

Such properties as solvent resistance, electrical resistance at elevated temperatures, and dimensional stability are roughly related to the heat distortion temperature of the plastic. This latter property is easy to measure by standard procedures so in our experimentation we strove for high heat distortion products. We screened dozens of hardeners for epoxy resins and determined the resin-to-hardener ratios giving maximum heat distortion temperature (see Table III). From this work we found methylene dianiline to be a suitable hardener in many applications.

In developing a resin suitable for encapsulating delicate components there are at least two possible approaches: 1) to match thermal expansion coefficients as closely as pos-

Table III—Physical Properties of Several Epoxy-Hardener Systems

Resin	Composition: Hardener	Ratio	Flexure strength	Impact strength	Heat distortion temperature °F.	Insulation resistance at 250° F.
Epoxy A	1	4:1	14,800	0.33	165	5000 Megohms
A	2	4:1	18,900	0.35	227	10^6
B	2	4:1	18,600	0.37	265	10^6
B	3	6:1	19,600	0.48	267	
C	2	4:1	17,500	0.25	314	
C	3	6:1	18,700	0.24	307	
C	4	100:6	15,100	0.23	169	4.8×10^5
C	5	100:13	14,200	0.40	169	5.5×10^4
C	6	10:11	9,800	0.26	345	
C	7	10:4	12,400	0.25	163	

Epoxy A = BRR18795 (Bakelite)
B = BRR18774 (Bakelite)
C = Epon 828 (Shell)

Hardener 1 = BRR18793 — Bakelite Co.
2 = Methylene dianiline — The Dow Chemical Co.
3 = Metaphenylene diamine — E. I. du Pont de Nemours & Co.
4 = Piperidine — E. I. du Pont de Nemours & Co.
5 = Curing Agent D — Shell Chemical Co.
6 = Chlorendic anhydride — Velsicol Corp.
7 = Phthalic anhydride — Allied Chemical & Dye Corp.

Table IV—Thermal Expansion Coefficients of Several Casting Compositions

Resin	Hardener	Fillers	Ratio	Mean expansion −65 to 75° F.	Coefficient in./in.°C. × 10^{-6} 75 to 165° F.
A	1		4:1	50	75
A	1	1	4:1:5	30	45
A	1	1 + 2 (50:50)	4:1:9.4	25	35
A	2		4:1	48	60
A	2	1 + 2 (50:50)	4:1:9.4	18	28
A	2	1 + 2 (50:50)	4:1:15	18	22
A	2	3 + 4 (2:1)	4:1:15	17	19
A	2	4	4:1:7.5	20	23

Resin A — BRR18795
Hardener 1 — BRR18793
Hardener 2 — Methylene dianiline

Filler 1 — Microsil special
Filler 2 — Silica sand
Filler 3 — Glass bead
Filler 4 — Fused quartz

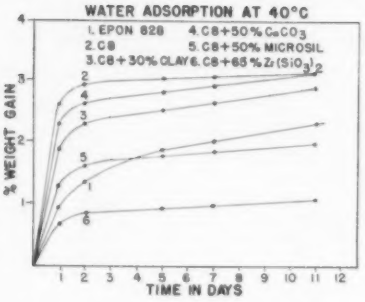


Fig. 4—Solvent resistance of different epoxies to water, and effect of fillers

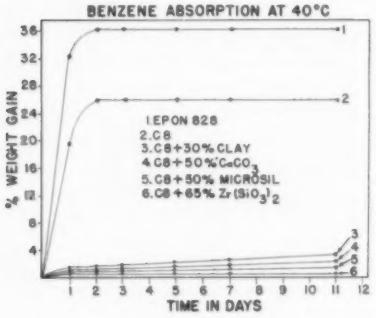


Fig. 5—Solvent resistance of different epoxies to benzene, and effect of fillers

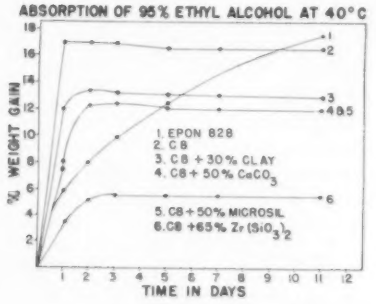


Fig. 6—Solvent resistance of different epoxies to ethyl alcohol, and effect of fillers

sible and 2) to develop a resin with such a low modulus that straining takes place within the plastic without stressing delicate parts beyond the yield point.

We concentrated our efforts on the first approach. In this program we screened dozens of inert mineral fillers, incorporating as much filler as possible and still maintaining a pourable mixture. Bars were cast and (Table IV) the thermal expansion coefficient was determined by measuring the length of the bar at several temperatures. Compositions were developed with thermal expansion coefficients so low that encapsulated glass radio tubes could be cycled from —85 to 165° F. without crushing the tubes.

Of course, other properties such as moisture resistance and electrical insulation must be maintained. The seventh composition in Table IV, for example, which has the lowest expansion coefficient, failed miserably when subjected to humidity cycling.

In certain applications, good solvent resistance was required. To evaluate different materials, thin specimens (0.010 in.) were immersed in various liquids and the weight increase over time was measured (see Figs. 4, 5, and 6). Some differences were found in solvent resistance between several available epoxy resins. The effect of fillers was even more pronounced. Zirconium silicate was particularly noteworthy in giving good solvent resistance.

The degree of cure has a more pronounced effect on solvent resistance than on mechanical properties. In fact, solvent resistance is one of the more reliable methods of ascertaining degree of cure. On the basis of certain assumptions and estimates made by Flory *et al.*[1], we estimated the average molecular weight between cross-links (Table V) in

[1] J. Chem. Phys. *11*, 521 (1943).

Table V—Average Molecular Weight Between Cross-Links

Room-temperature cure (16 hr.)	4000
Postcure, 1 hr. at 200°F.	1600
Postcure, 16 hr. at 200°F.	1100

Bakelite's C-8 Resin (BRR 18795-18793).

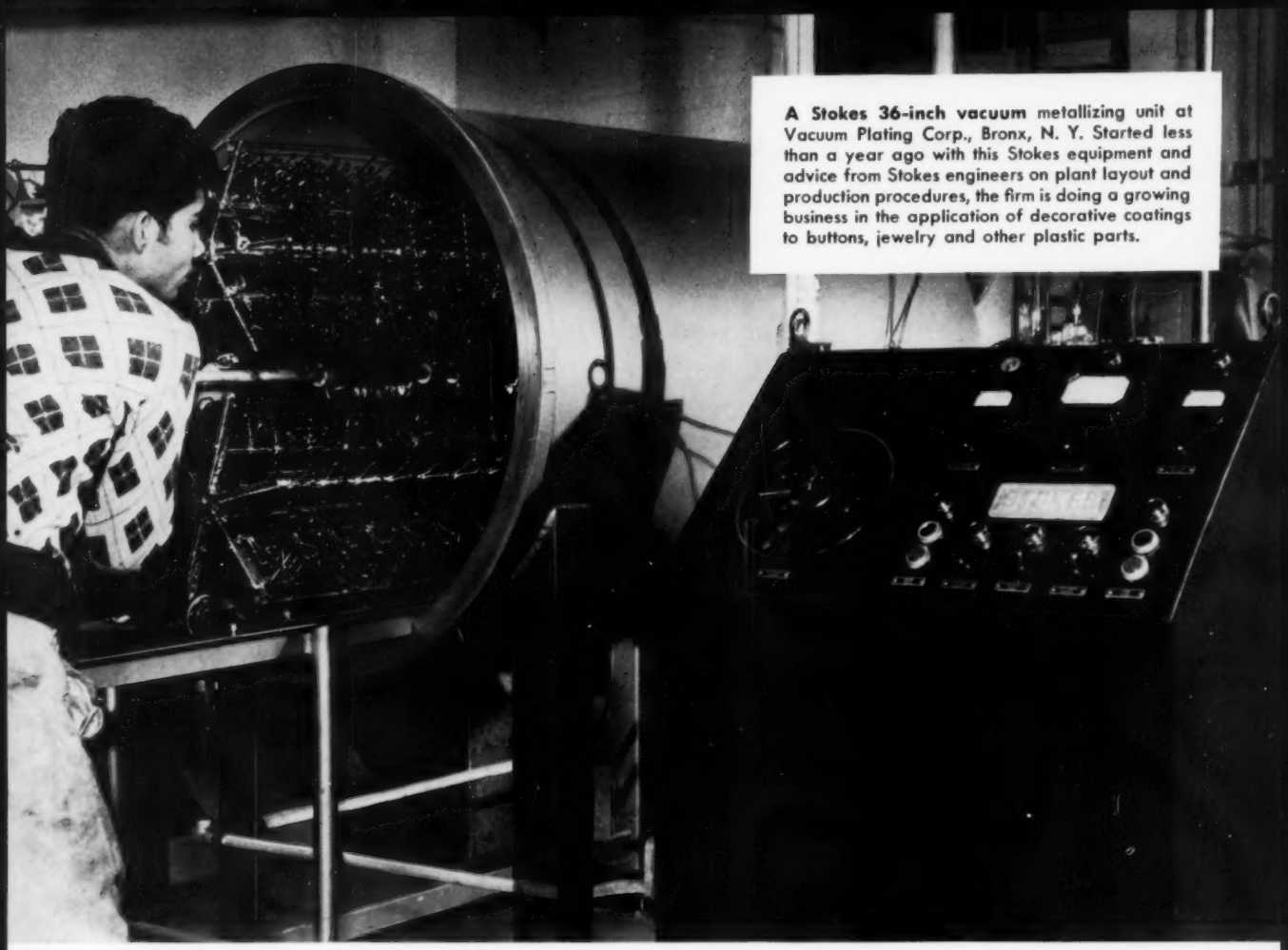
Dissipation of heat becomes a problem when cartain heat producing components, such as radio tubes, are encapsulated. Although the use of metal foils and favorable geometry frequently solves the problem, we developed a casting resin having a ten-fold improvement in thermal conductivity. Thermal conductivity measurements were made on standard slabs about ⅛ in. thick using the Cenco-Fitch apparatus and method[2] (Fig 7).

Unfilled epoxy resins have thermal conductivities in the range of 4.7 to 5.4 $\times$ 10^{-4}. Mineral fillers such as in Table IV improve the thermal conductivity two to three times. Our

[2] "Experiments in Physics." Ingersoll and Martin, McGraw Hill, Inc., 1942, p. 133.

Fig. 7—Measurements of thermal conductivity of epoxy resins were made on standard slabs about ⅛ in. thick, using the apparatus shown in the illustration below

Illustrations with this article, courtesy Minneapolis-Honeywell Regulator Co.



A Stokes 36-inch vacuum metallizing unit at Vacuum Plating Corp., Bronx, N. Y. Started less than a year ago with this Stokes equipment and advice from Stokes engineers on plant layout and production procedures, the firm is doing a growing business in the application of decorative coatings to buttons, jewelry and other plastic parts.

The first high-production vacuum metallizer selling for less than $10,000

Brilliant, durable, metallized plastics are produced in quantity at Vacuum Plating Corp., Bronx, N. Y.

For firms just entering the vacuum metallizing business or for those expanding their operations in this growing finishing field, the Stokes 36-inch metallizing unit offers unusual advantages:

1) Low cost
2) Fast, 15-minute over-all cycle time
3) Simplified, push-button operation
4) High capacity . . . 200% greater than conventional 30-inch units
5) Interchangeability . . . the four part racks can be used in larger Stokes units, if operations demand more capacity.

Stokes builds vacuum metallizing equipment in 24, 48 and 72-inch sizes as well. Our vast experience in the application of this popular finishing method is at your service, to metallize your sample parts and advise on efficient plant layout. Send for an informative brochure on the Vacuum Metallizing Process, Catalog 780.

F. J. Stokes Machine Company, Philadelphia 20, Pa.

OFFICES IN PRINCIPAL CITIES, REPRESENTATIVES THROUGHOUT THE WORLD

STOKES

Table VI—General Properties of Epoxy Molding Compounds

	ASTM Number	
Bulk	D392-38	3:1 to 8:1
Molding temperature		290 to 315° F.
Molding pressure		15 p.s.i. to 3000 p.s.i.
Cure time		3 to 10 min.
Mold shrinkage		0.0027 to 0.005 in./in.
Impact strength	D256-47T	0.4 to 16 ft. lb./in. notch (Izod notched)
Flexure strength	D790-49T	7000 to 14,000 p.s.i.
Tensile strength	D651-48	Over 8000 p.s.i.
H_2O absorption (24 hr.)	D570-42	0.05 to 1%
Volume resistivity	D257-49T	0.10^{12} ohms
Heat distortion temperature	D648-45T	217 to 110° F. at 264 p.s.i.

Table VII—General Characteristics of Epoxy Foams

Foaming temperature	225 to 250° F.
Cure time	1 hr.
Expansion	8 to 12 times liquid volume
Shrinkage from mold	1 to 5%
Compressive strength	75 p.s.i.
Density	5 to 7 lb./cu. ft.
Cell structure	Mostly disconnected
Buoyancy	45 to 50 lb./cu. ft.
Electrical resistivity at 325° F.	10^6 Megohm

best heat conducting casting composition is heavily filled with aluminum powder and has a thermal conductivity of about 50×10^{-4}. Surprisingly, the electrical resistivity of this material is 500,000 megohms.

Casting Problems

Because of the intrinsic adhesive properties of epoxy resins, casting operations are usually complicated by mold release problems. Teflon coatings fused on aluminum or steel molds are excellent from the standpoint of release, but are expensive to maintain. Silicone resin coatings are good, but also expensive to maintain. Silicone oils and greases work well in many applications, but do not give the ultimate in surface finish and fail to release some highly filled compositions. Carnauba wax dissolved in naphtha is easy to use and gives a good surface. Carnauba wax fails, however, when curing temperatures above 180° F. are used. Damar wax dissolved in naphtha is an excellent mold release for temperatures even above 200° F.

Molding Compounds

Epoxy molding compounds incorporating the good inherent properties of epoxy resins have been developed (Table VI). Although these compounds are more expensive than most commercial molding materials, there are some applications where no other known material will do a satisfactory job. They become very fluid at mold temperatures, making it possible to make parts having thin sections and to fill molds containing fragile inserts.

The molding cycle of epoxy molding compounds has recently been reduced from 10 min. to 3 to 5 min. by the use of an accelerator like catechol. When the part is removed from the hot mold, it is slightly soft and may be distorted. This can be remedied by using cooling fixtures or merely by reheating in an oven where recovery takes place by virtue of plastic memory.

The base resin used in this work was Epon 1001 with methylene dianiline as hardener. Various mineral fillers and synthetic fibers were incorporated to vary the physical properties.

Table VIII—Epoxy Foam Formulation Suitable for Encapsulating

BRR-18774	71.0 Parts
Methylene dianiline	17.0
Naphtha	12.0
Celogen	1:1 to 1.5
Pluronic L-64	0.05

The general characteristics of epoxy foams are given in Table VII. In control devices going into aircraft, it is desirable to encapsulate components yet add as little to the total weight as possible. For this purpose a foam-in-place epoxy resin was developed having a density to 6 to 7 lb./cu. foot. The formulation of this foam is given in Table VIII.

To get a satisfactory epoxy foam it was necessary to get a proper balance between the curing rate of the resin and the action of the blowing agent. Blowing agents evaluated ranged from finely divided solids containing absorbed gas to chemical blowing agents which decompose thermally to produce gases. Celogen[3] was found to be one of the better blowing agents for our purposes.

Certain surface active agents were found to have a great effect on the quality of the foam. Of several nonionic surfactants tested, the Pluronics[4] were outstanding in producing a fine uniform cell structure.

The high heat of polymerization of epoxy resins caused charring at the core when volumes larger than a half pint were foamed. Such volatile liquids as ethylene dichloride and naphtha were found useful to absorb some of this exotherm.

Conclusion

A new family of plastic materials, the epoxy resins, have been put to use in the few years of their existence in several very important groups of applications. Their initial use as adhesives led very soon to their applications in the coatings industry. The strength characteristics of these resins made them suitable for foam uses. Their excellent low-shrinkage characteristics made them admirably suited for encapsulating and potting applications while an observation that the excellent adhesive characteristics could be reduced by a suitable hardener made their use as molding compositions practical.

Thus, we have a material which can be used to form films, foams, and solids. This is indeed an unusual material and will have many more interesting uses in the future.

[3] Product of Naugatuck Chemical, Div. of U. S. Rubber Co.
[4] Product of Wyandotte Chemicals Co.

Treating Polyethylene for Printing

An evaluation of existing methods by which polyethylene surfaces can be prepared for ink adhesion

by STANLEY F. BLOYER*

A REAL understanding of the fundamental problems of ink adhesion on polyethylene must start with the knowledge of the various methods which have, at one time or another, been employed for this purpose. Only when the shortcomings and advantages of each method are appreciated can the method be selected which is best suited to a given job.

Stretching

Probably the first procedure to show any promise was that which involved the physical reorientation of the material by stretching in the cold state. This apparently ruptured some of the long chain molecule linkages, creating an affinity at the point of rupture. However, the effect was limited, and the impracticality of using this method with anything other than film made this method of physical reorientation unsuitable for production work and relegated it to a laboratory curiosity.

Chemical Etching

Another early approach was the use of a chemical bath to etch the surface, providing relief from surface tension and an enormously greater contact area upon which the ink was supposed to be able to get a "tooth." This method, likewise, had fundamental failings in that it did nothing to lessen the chemical inertness of the surface, which militated against the chemical combination of the ink solvents with the polyethylene in spite of enhanced physical characteristics. Further, the cost of handling and washing or neutralizing the baths left much to be desired in handling costs, even if the method itself were, from a technical standpoint, feasible.

A likely approach to a fundamental solution to the problem came when chlorination of polyethylene was achieved by exposing the polyethylene surface to the simultaneous action of ultra-violet radiation and chlorine gas. The apparent result was the replacement of some of the hydrogen atoms by chlorine in some of the surface polyethylene molecules. This created a new surface compound which showed an affinity for several specially formulated inks. Aside from the limitation in ink characteristics, the practical problems leading to the discard of this method involved both the cost of treatment and the uncertainty of treatment values, even on adjoining areas. A patent was granted on the chlorination process but apparently is not in use today.

Through other developments in the field, it became apparent that it was desirable to create a condition whereby any free chemical could be made to adhere to a surface of the polyethylene. A method was devised in the laboratory which was theoretically feasible but commercially impractical. This involved the use of a series of liquid chemical baths and washes which would create an unsaturated surface. However, the cost and difficulty of maintaining solution strength and the proper relative values of each bath with the others account for no commercial use being currently made of this method.

Heat Differential

Another method is the Kreidl heat differential method[1] wherein the apparent effect is the release of surface tension through the application of heat. According to the patent which has been issued on this method, "the most simple way of obtaining this aim is to . . . subject the surface to a hot blast of air for a relatively short period of time." Also according to the patent "while this beneficial treatment can be carried out *before* or *after* the actual printing, the beneficial effect will be definitely dependent on the time lapsed between the treatment and printing, if printing is effected after the heat treatment. It appears that under the influence of the underlying layers, the quenched surface will slowly reorient itself and lose its activated state, or in other words, its bonding capacity."

It would appear that a practical

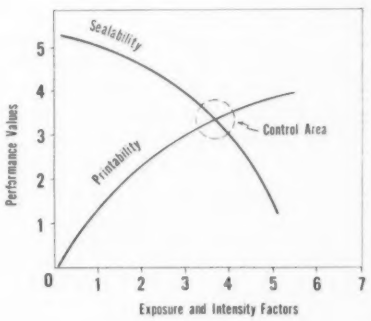


Fig. 1—Control area is that group of performance values where sealability and printability curves intersect

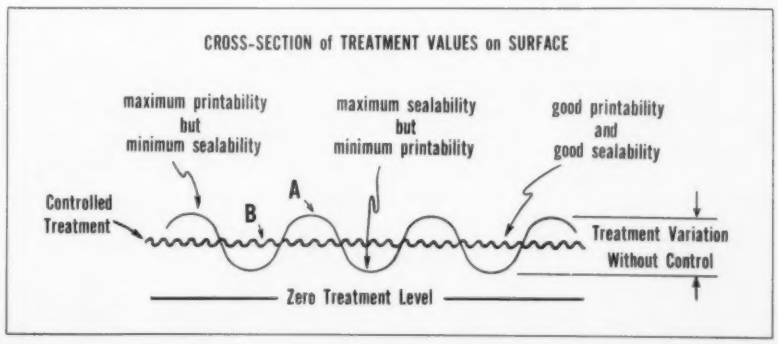


Fig. 2—Variations in treatment values with no control (curve A) and with precision control (curve B); the latter indicates a decidedly more uniform treatment pattern

[1] W. H. Kreidl patent No. 2,632,921.

* Modern Plastic Machinery Corp.

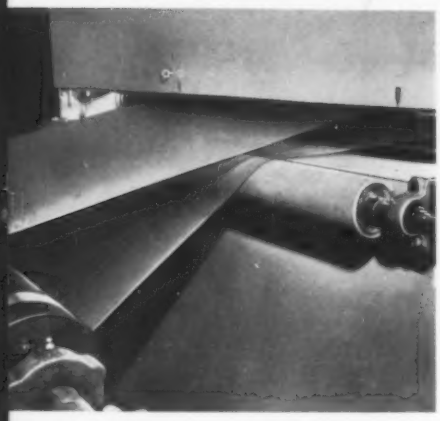


Fig. 3—Feed and rewind side of electron bombardment machine for polyethylene treatment (see photo below)

difficulty of the heat differential method lies in the control of the hot air (or infra-red radiation which the patent also recommends) as to temperature and volume which could be widely affected by atmospheric conditions, drafts, insulation, etc.

One of the more important factors in considering the use of the heat treatment method has to do with the oxidation of polyethylene. It is well known that in the presence of air, a polyethylene surface will instantly oxidize if it is in molten form. The Kreidl patent specifies that the polyethylene surface shall be permitted to melt, then harden, thereafter applying the decorative matter. Since no provision is made for the exclusion of air, the resultant condition is one in which the surface is oxidized, causing a deterioration in tensile strength, possible discoloration, and, in effect, accelerated aging of the polyethylene. Depending upon temperature and exposure time, the treated portion will be oxidized over its entire surface. Ink receptivity is then based on the increase in surface polarity, a factor insufficient to obtain commercial values of ink adhesion.

Electron Bombardment

Simultaneously with the above-mentioned developments, a fundamental approach to the treatment of polyethylene to achieve a permanently ink receptive surface together with a controllable level of treatment value, was made through the use of energy impingement or electron bombardment. This was expressed ultimately in two separate patent families: the George W. Traver electron bombardment method[2] and the M. F. Kritchever[3] flame contact method. In both cases the operation is basically the same: intense energy is caused to impinge upon the surface molecules, causing the relatively unstable hydrogen atoms to leave the compound, resulting in a substantially unsaturated surface. Several advantages result from this procedure. First, treatment creates a network of long chain double bonds which improves the tensile strength of the material and permits a reduction in the elongation factor, if desired.

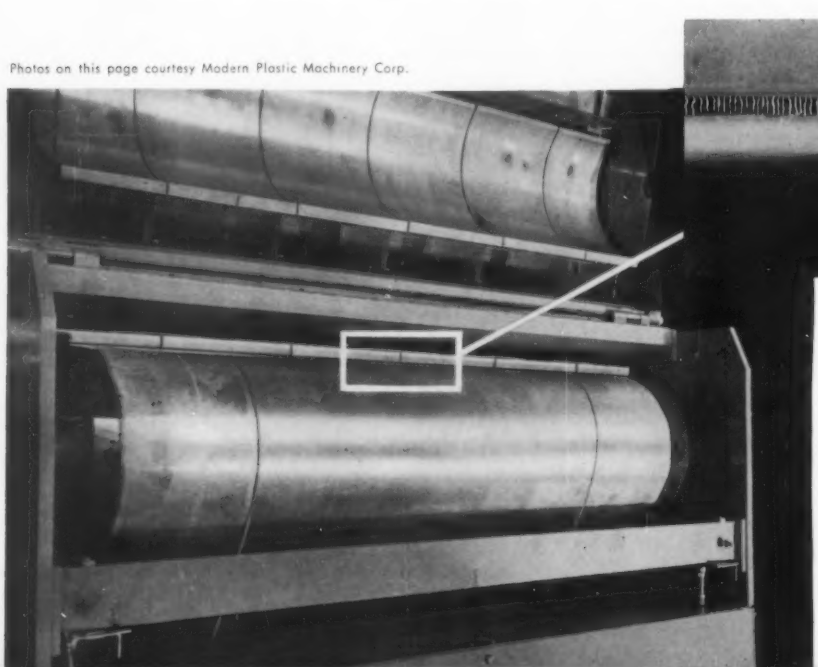
[2] Patents pending.
[3] M. F. Kritchever patents No. 2,648,097, No. 2,683,894.

Secondly, the very substantial unsaturation of the surface molecules means that those surface molecules are prepared to unite with virtually any free chemical compound, so that any ink currently being used for cellophane, vinyl, paper, etc., will show good bonding properties. Of course, the ultimate quality of the printed or decorated polyethylene will also be dependent upon the resistance to solvents, fats, etc., of the ink itself. Under certain extreme conditions, the inks may deteriorate, either separating due to poor cohesive value or otherwise being damaged by exposure to conditions unsuitable to the ink itself. However, it can be shown that properly treated polyethylene will not permit the separation of almost any ink from it once that ink is thoroughly dry, regardless of the deteriorating effect upon the surface of the ink itself by outside influences.

A further advantage of the flame contact and electron bombardment methods is that there is no loss whatever in ink bonding characteristics regardless of the time that elapses between treatment and application of inks. This is due to the fact that a permanent physio-chemical change is effected by the treatment.

Evaluative tests conducted by Dr. R. K. Summervell, head of the Department of Chemistry, Northwestern University, and Dr. Malcolm Dole, Professor of Physical Chemistry, Northwestern University, substantiate that permanent receptivity and the creation of unsaturated

Photos on this page courtesy Modern Plastic Machinery Corp.



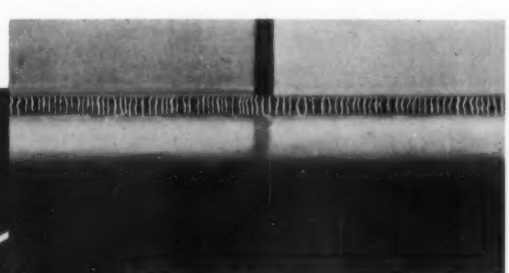
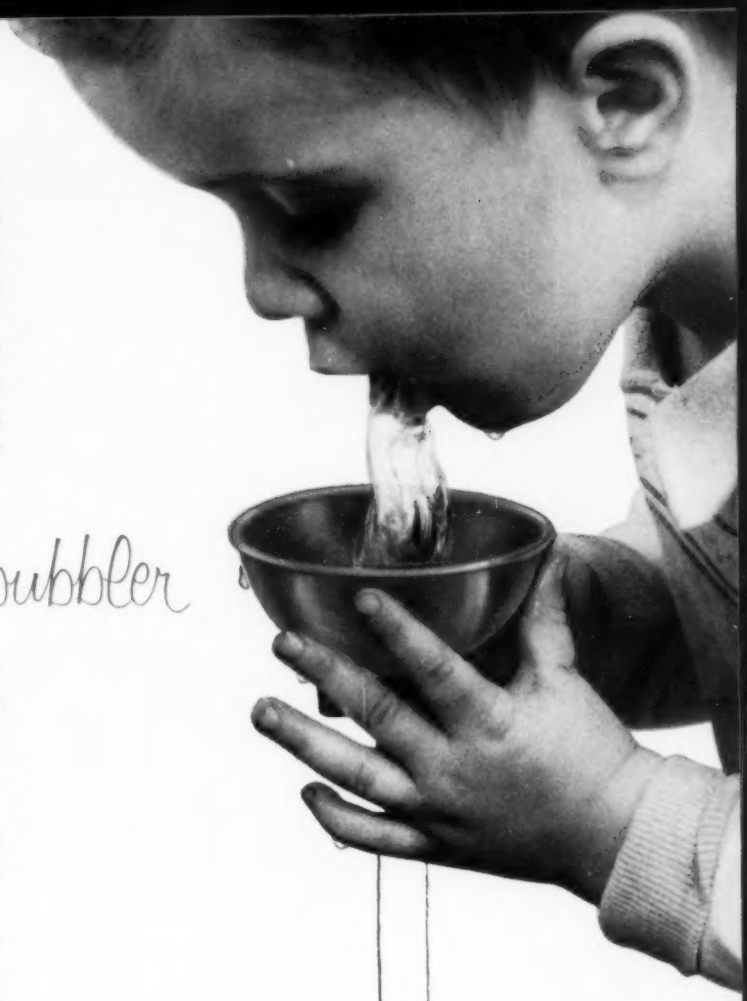


Fig. 4 (left)—Interior view of electron bombardment machine, showing polyethylene film passing between electrodes

Fig. 5 (above)—Close-up of section of bombardment machine, showing electronic discharge between electrode at top and polyethylene film passing underneath it

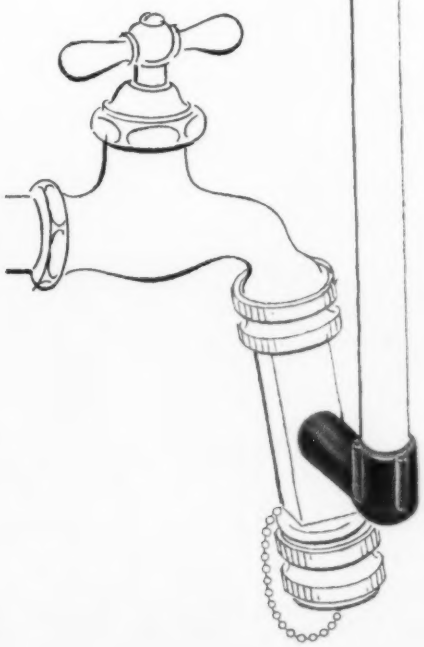


A MOLDED FOUNTAIN CUP and elbow fitting of tough green Tenite Butyrate are assembled with metal tubing and fittings to form the Backyard Bubbler — a drinking fountain that screws onto outdoor faucets. With the fountain in place, the Butyrate cup at the upper end of the assembly lifts to start water flowing. At the lower end, a garden hose can be attached simply by removing the fixture's screw-on cap.

backyard bubbler

Butyrate was selected for important Bubbler parts because of its exceptional durability under outdoor exposure and contact with water. Cup and elbow have rugged impact strength and remain permanently free of rust. Their pleasing green color can't chip or wear off — it's part of the Butyrate material.

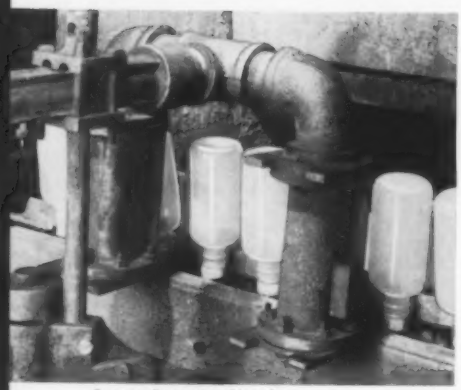
Today you'll find Tenite Butyrate a prime material for use in such items as garden tools, lawn sprinkler systems, and sports equipment of many kinds. Why not send for an illustrated booklet about Tenite properties and uses? Write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.



TENITE
BUTYRATE
an Eastman plastic

• Backyard Bubbler manufactured for Breck's Of Boston by Research Engineering Co., Eastondale, Mass. Tenite Butyrate parts molded by Standard Plastics Co., Inc., Attleboro, Mass.

• Information regarding Tenite also can be obtained from local representatives listed under "Plastics — Tenite" in the classified telephone directories of the following cities: Chicago, Cleveland, Dayton, Detroit, Houston, Leominster (Mass.), Los Angeles, New York City, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, Seattle, and Toronto—elsewhere throughout the world, from Eastman Kodak Company affiliates and distributors.



Courtesy Decorative Glass Co.

Fig. 6—Typical set-up for surface treatment of polyethylene bottles

Courtesy Decorative Glass Co.

Fig. 7—Arrangement for surface treatment of flat injection molded articles

double bonds is common to both methods of energy impingement—electron bombardment and flame contact.

Important Exception

All tests show that the end result of treating by flame contact or electron bombardment are the same with one important exception: since electron bombardment involves no heat able to melt the polyethylene, it is not subject to oxidation other than by normal aging; on the other hand, flame-contact treated polyethylene will show oxidation, but only up to 3% of its surface. Established laboratory techniques permit ready identification of the method used to treat a given sample.

Specifically, the Traver method is purely electrical and generates no heat. It consists of a method of generating high-impact, high-intensity electron bombardment of the surface to be treated. Basically, the equipment consists of a capacitive system energized by high voltage. Because of the efficiency of this method of creating "energy-impingement," the current consumption is very low. On the average, approximately 25,000 sq. ft. of surface can be treated for one cent. The equipment is primarily adaptable to films and light sections, although its use need not be limited to such. The equipment may be employed at the extruder, at the slitter, or as part of the printing apparatus. The polyethylene material may be treated, shipped, and stored for indefinite periods without any loss of ink retention capabilities.

Precise control under all conditions is obtainable. For example, flat, tubular, or gussetted film in any width or gage may be run through a wide range of speeds, and material of widely divergent molecular weights may be used, with the treatment value held at a constant level.

The question of treatment value is of considerable importance since an increase in ink receptivity results in a corresponding decrease in heat sealability. Since it is possible to achieve desirable levels of both ink adhesion and heat sealability in a given piece, it is vital that the control of treatment level be as sensitive as possible.

Control Area

In Fig. 1, the control area is that portion of the treatment range where both printability and sealability are served. Each firm, however, can set its own performance values, placing the treatment range high or low according to the relative importance of each factor for its own purposes. Figure 2 shows schematically what occurs in treatment values across a treated surface of polyethylene where precision control is used and, by contrast, where only general control is exercised. Curve "A" shows the variation in treatment value that occurs without control, at adjacent points or areas. Since frequently the points or areas of low treatment value are common enough to cause a generally poor adhesion of ink (particularly in flexographic inks which have relatively poor cohesive strength), the operator will attempt to upgrade the treatment by giving more time or greater energy input. This only results in moving the variation pattern to a higher plateau wherein the values severely inhibit sealability and are sufficiently prevalent to reduce the average sealability value below commercial acceptability.

On the other hand, curve "B" in Fig. 2 shows a substantially uniform treatment pattern, wherein neither high nor low points differ significantly. Thus, a change of treatment value to a different plateau is not marked by excessive variations and may be made with assurance that only such printability or sealability changes as are desired will occur.

Courtesy Plastray Corp.

Fig. 8—Measuring cup will be printed only on sides; thus, only sides are treated

Evaluative Procedures

Control is obtained primarily through a careful matching of electrical characteristics in all operating components of the treating apparatus, and the simple evaluation of the material being treated. Evaluative procedures have been worked out and standardized by the process owners[1] and are available.

As Figs. 3, 4, and 5 show, the treatment of film is affected by passing the material between two electrodes. These must have distinctive discharge characteristics and are energized by a power source having controlled input characteristics provided by electronically matched components.

The Kritchever patents were granted specifically on claims involving the use of a flame to contact or bathe the surface to be treated. The importance of flame contact is that

(*To page* 205)

[1] Traver Investments, Chicago, Ill.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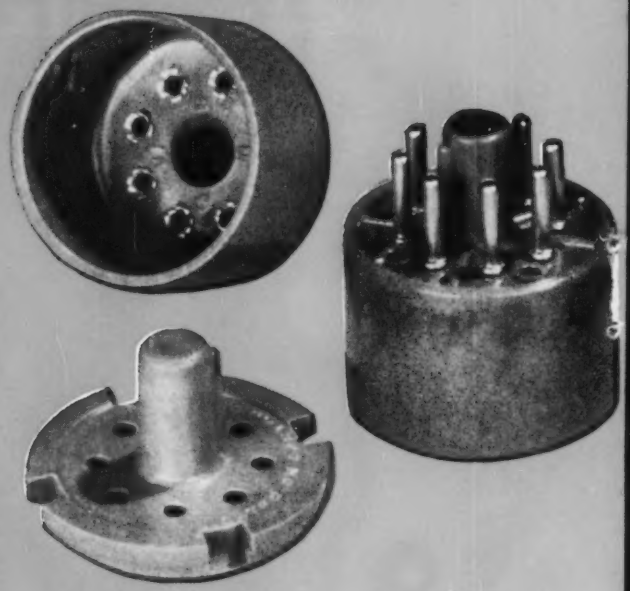
Road markers by
Plastic Engineering Inc., Cleveland 2, Ohio

This bright red molded road marker makes good use of the inherent toughness of BAKELITE Brand Vinyl Elastomeric Plastics. It's virtually immune to rough treatment. The color goes completely through, can't be scuffed off. The pyramid shape and the correct specific gravity of the plastic keep the marker in place when it's set over a freshly-painted traffic line.

BAKELITE Vinyl Elastomeric Plastics stay resilient even at below-zero temperatures. Their flexibility can be varied from semi-rigid to soft, depending on the amount of plasticizer used in their formulation. A wide range of colors is available. These materials are faithful to mold details and provide high surface gloss.

BAKELITE
PHENOLIC
PLASTICS



Vacuum tube bases molded by
Sylvania Electric Products Company, Warren, Pa.

With its excellent high-frequency insulating characteristics, BAKELITE Brand "Low Loss" Phenolic BM-17748 is an ideal material for these molded vacuum tube bases. For example, its minimum dielectric strength is 325 volts/mil, while power factor ranges from 0.025 at 60 cycles down to 0.010 at 1,000,000 cycles. Consequently, this material is recommended for a wide range of electronics applications including coil forms, resistors, and capacitor housings.

BM-17748 is also more resistant to moisture and more dimensionally stable than most phenolic molding materials. It can be used not only where its outstanding electrical properties are paramount, but also in a variety of other applications where these additional service properties are useful.

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Your product, its sales and profits depend in great measure on the quality of the materials you specify. That's why so many molders and fabricators rely on Bakelite Company for their basic requirements.

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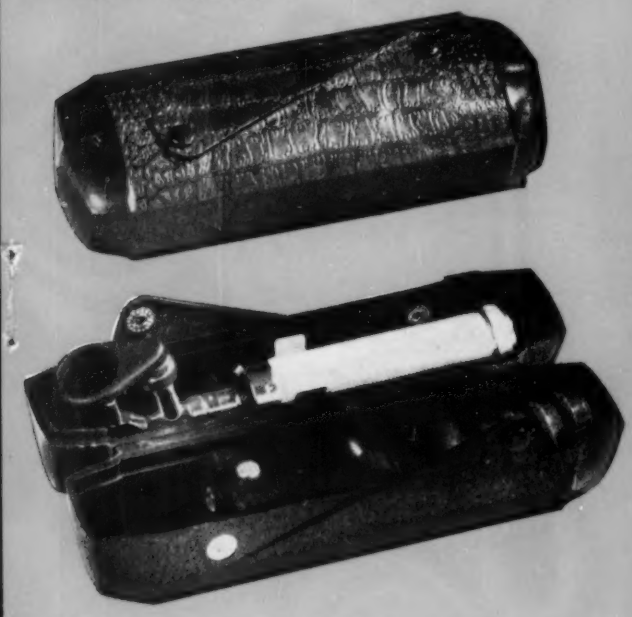
In addition, Bakelite Company engineers—backed by over 45 years of plastics research—offer technical advice or assistance whenever you need it. If you have a problem in materials selection or processing, talk it over with the Bakelite Company sales representative nearest you. Or write Dept. JI-104.

BAKELITE

POLYETHYLENE

PLASTICS



Instrument case molded by **Auburn Button Works, Inc.**, Auburn, N. Y., for Welch-Allyn, Inc., Skaneateles Falls, N. Y.

Cleverly designed, this entire case for diagnostic instruments is one-piece molded of BAKELITE Brand Polyethylene. Compartments, hinge, flaps, and the simulated alligator surface were all formed in a single operation. In service, the resilient polyethylene makes the case shock-proof and virtually indestructible. It can be sterilized in standard germicides; polyethylene is inert to most chemicals.

Although lightest of all commercial plastics, BAKELITE Polyethylene provides husky construction. It's tough and flexible, even at –70 degrees F. Other advantages include outstanding dielectric properties, making it an especially important extrusion material for wire and cable construction.

BAKELITE

C-11

PLASTICS

Cell cases molded by **Plastic Mold and Engineering Co.**, Providence, R. I. for Sonotone Corp., Elmsford, N. Y.

These battery cell cases, molded of BAKELITE Brand C-11 Plastic, are designed to give many years of service, according to the manufacturer. The plastic, an acrylonitrile-styrene copolymer, is so chemical-resistant that it withstands contact with highly corrosive electrolyte—a 30%-by-weight solution of potassium hydroxide in distilled water. It's so tough that a "shake test" shows it can take stresses as high as 500 cycles at 15 G's.

BAKELITE C-11 Plastic is also used for the cover, which is cemented to the case, making the cell a sealed unit with the sole exception of the vent plug. The high degree of transparency found in C-11 Plastic permits visual inspection at all stages of the battery's manufacture.

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BRAND
PLASTICS

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design makes a difference . . . . . *and*

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Engineering a New Case

Design of a lightweight carrying case for the Dictaphone Time-Master dictating machine called for solution of many forming problems

EVER since 1948 when Dictaphone Corp. brought out its first portable dictating machine using a plastic belt record, their engineers and designers have concentrated their efforts on improving the quality of the recording unit and reducing the over-all weight of the machine and carrying case. The first case was made of Fabrikoid-covered plywood and weighed 5½ lb.; the machine itself 20½ lb., a total of 26 pounds. Today, the case is made of styrene copolymer sheet and weighs 3 lb.; the machine 12 lb., a total of 15 lb., for an over-all weight reduction of 11 pounds.

In the evolution of the case, plastics sheet was first used simply as an insert in the plywood cover. The sheet was formed to fit the top of the machine so that it would be held firmly in position when the case was closed. This formed sheet replaced several wooden ribs and pieces of sponge rubber (Fig. 1) which had been glued into the plywood case.

The next step, after the formed insert had proved satisfactory, was the design of an all-plastic case formed from styrene copolymer sheet. This case was just about a design duplicate of the plywood case and was equipped with the same separate formed insert. Because of rigidity requirements, it was necessary to use aluminum extrusions around the edges of the top and bottom. This second case weighed 5¼ lb., a saving of only ¼ lb.; however, it was less costly and had a neater appearance both inside and out.

Design and Production

Steiner Plastics Mfg. Co. Inc., Glen Cove, L. I., N. Y., then undertook the development of a design which would eliminate the insert as well as the metal extrusions. They were successful, as can be seen in the second half of Fig. 1. It was a lot easier, however, to design the case than it was to develop a method for forming it. Rigidity was obtained by the valance design of the mating edges of the two halves of the case. In each half, the material of the case is turned inward at 90° from the sides; in the bottom half of the case, an additional bend of 90° in the opposite direction serves to make a more perfect closure in the finished case. These edges, however, were undercuts which greatly increased the problems of mold design and forming methods. The undercut problem was solved by using removable mold bar sections around which the material was drawn.

Because of the extra draw around the mold bars, in addition to the vertical draw, it was found that the four corners of the case bottom were

Fig. 1—Early carrying case (left) of Fabricoid-covered plywood had wooden ribs, sponge rubber pieces; new model (right), formed of copolymer sheet, is 2½ lb. lighter

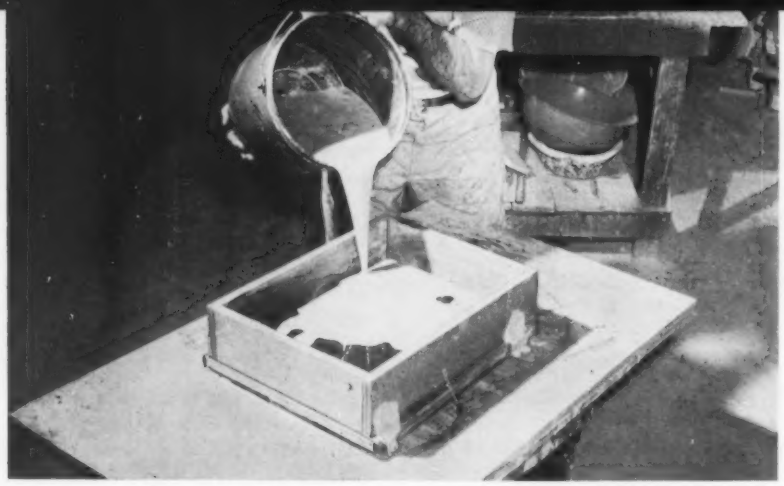


Fig. 2—Female plaster cast is made on plastic form which consists of a heavily grained styrene copolymer sheet shaped to the contours of one half of the carrying case

Fig. 3—As first step in production of dictating machine carrying case, 13½- by 17½-in. styrene copolymer sheet is locked in two-part clamping frame

Photos courtesy Steiner Plastics Mfg. Co., Inc.

Fig. 4—Next, removable mold bar sections for forming of undercuts are placed in position in the mold. These undercuts were incorporated in carrying case design to increase rigidity

thinning out so much as to be unacceptable. First a partial (not the full depth) male plug was tried which stretched the sheet part-way into the cavity before air pressure was applied to finish the draw. This helped but was not enough. Then an idea was developed which was unique as well as successful. Reasoning that if the portions of the hot sheet which would form the corners could be partially cooled, thinning would be reduced at those points, air jets were installed in the lower four corners of the male plug. The sequence of operation was then as follows: the heated plastic sheet was placed in position on the female blow mold, the male plug was lowered until a partial draw had been effected, and at the same time the pressure head clamped the edges of the sheet. Air pressure was then exerted against the sheet to complete the draw, but since this pressure came from the four air jets in the lower corners of the plug it served to cool the plastic just in the corners and reduced the thinning-out so much that the required strength was retained.

Economy and Sheet Size

It is always the aim of sheet formers to reduce as much as possible the size sheet needed to form a part. Many molds are designed so that the pressure head "doubles in brass"

as the sheet clamp. Operating in this fashion required a sheet measuring 14½ by 18½ in. in order to get sufficient clamping area. A novel two-part clamping frame was devised which was assembled on the sheet cold. Strong springs caused the clamp frame to grip the edges of the sheet with such force that it was possible to reduce the sheet size to 13½ by 17½ in. and still have sufficient clamping area. This figures out to be a reduction of 66 sq. in. of material per half or about 130 sq. in. per case—a sizable cost reduction.

Surface Grain Restored

Another problem which cropped up was the loss of grain from the material surface due to drawing. It was decided that if the mold surface was grained, it would serve to maintain a satisfactory grained surface on the sheet.

To get the grained surface in the mold the following steps were pursued: a sheet of heavily grained styrene copolymer sheet was carefully formed to the contours of each case half. A female plaster was then cast on each plastic form (Fig. 2), and a male plaster was taken from the female plaster. After this, a cast phenolic female mold was cast using the male plaster as the pattern. Throughout all of these steps the grained surface of the original plastic sheet was retained.

Now, after all the development

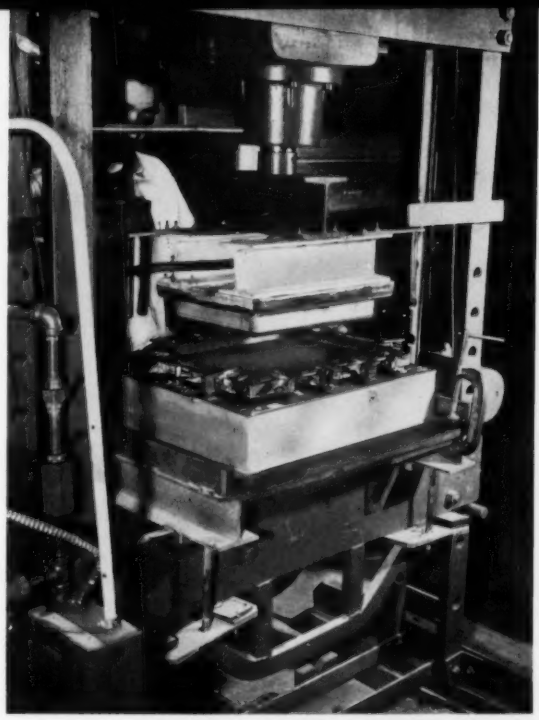
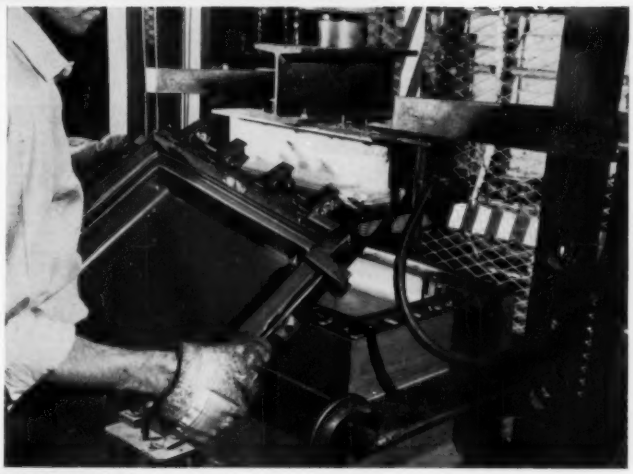


Fig. 5—After sheet in clamping frame has been heated in 400° F. oven for 7 min., and while it is still hot, it is placed on top of mold. Guide pins in mold and corresponding holes in frame insure accurate placement



Photos courtesy Steiner Plastics Mfg. Co., Inc.

Fig. 6—At end of cooling period which follows the forming operation, finished case half—still attached to clamp frame and with mold bars in undercut areas—is removed from mold

Fig. 7—Special jig, equipped with three clamps that open clamp frame, is used to remove formed part from frame

Fig. 8—After formed part has been removed from clamp frame, a special pulling device is used to withdraw the removable mold bars from the undercut sections of the piece

Photos courtesy Steiner Plastics Mfg. Co., Inc.

Fig. 9—Final assembly, done on production line, consists of riveting clasps, hinges, and handles, and gluing in machine feet supports, power cable holder, and felt pads

work has been completed, the production process is as follows: a sheet of 5/32-in. styrene copolymer sheet measuring 13½ by 17½ in. is locked in the clamping frame (Fig. 3) and then placed in a 400° F. oven for 7 minutes. In production, all steps in the forming operation are performed during the 7-min. heating period. The removable mold bar sections for forming the undercuts are placed in position in the mold as shown in Fig. 4.

The hot sheet, still in its clamping frame, is placed on top of the mold, accurate location being effected by guide pins in the mold and corresponding holes in the frame (Fig. 5).

The air-operated, downward acting ram then lowers the pressure head and male plug until the sheet is partially drawn and a hermetic seal is obtained between the pressure head and the top surface of the mold. Of course, the plastic sheet is between the two. Air pressure then forces the sheet downward and outward until its outer surface is in intimate contact with the entire mold surface.

As mentioned previously, the four air jets cool the corners so that stretch-down is greatly reduced at those points. After sufficient time (about 5 min.) has elapsed for cooling, the pressure head is raised and the part, still attached to the clamp frame and removable mold bars, is removed (Fig. 6). This assembly is then placed in a jig equipped with three clamps which open the clamp frame, permitting the part to be removed (Fig. 7). The mold bars are then withdrawn from the undercut sections by a special pulling device (Fig. 8).

Excess material is then routed off and the edge is polished to remove the cutter marks. Holes for mounting a piano hinge, handle, and locking clasps are then punched.

Final assembly, which consists of riveting the clasps, hinge, and handle, as well as gluing in machine feet supports, power cable holder, and protective felt pad is done on an assembly line, as in Fig. 9.

CREDITS: Case designed by Steiner Plastics Mfg. Co., Inc., Glen Cove, N. Y. Molders: Gregstrom Corp., Cambridge, Mass.; Regal Plastic Co., Kansas City, Mo.; Steiner Plastics Mfg. Co. Styrene copolymer case material: Boltaron, Bolta Products, Inc., Lawrence, Mass.; Royalite, U. S. Rubber Co. Cast phenolic mold material: Rezolin, Rezolin, Inc., Los Angeles, Calif.

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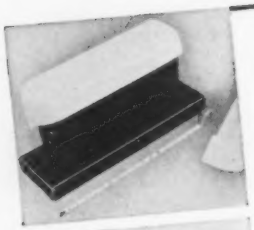

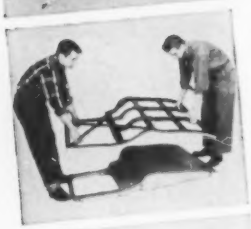

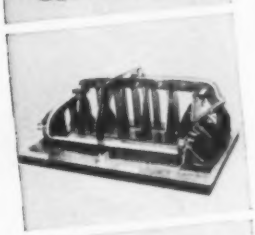

A Manual for Reinforced Plastic Tooling

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Mechanical Properties of

Rigid Plastics at Low Temperatures

Tensile and impact properties of 56 different rigid plastics were determined at 77, 10, —40, and —65° F. The materials tested comprised a representative selection from among the commercial types available at the beginning of the investigation. The properties measured were apparent modulus of elasticity in tension, ultimate tensile strength, percent elongation at break, work to produce tensile failure, and Izod impact strength. The data are presented as bar charts. The influence of temperature on each property of each material is shown, and comparison of performances over the entire temperature range is made possible. These charts may serve 1) as a visual aid to general appraisal and 2) as a source of quantitative engineering data.

by HENRY A. TISCH†

THE Ordnance Corps is vitally concerned with the accumulation of reliable engineering data on a wide variety of materials. Among the materials for which knowledge of engineering data is required are plastics. Of especial interest in this connection is the performance of such materials at various extreme conditions of environment, storage, and use. Previously available information has not included a sufficiently wide selection of materials, all tested under comparable conditions. Accordingly, the Ordnance Corps' Plastics Laboratory at Picatinny Arsenal has in progress a project that is supplying the Ordnance Corps with necessary engineering information on a wide variety of commercially available plastics. Using the same basic group of materials in each case, this laboratory has investigated or is investigating the following performance characteristics: mechanical properties at high and low temperatures; mechanical properties after high-temperature storage; mechanical properties after outdoor exposure; mechanical properties after storage in contact with petroleum and various petroleum products; and coefficients of linear thermal expansion over the temperature range of —65 to +166° F. This paper is a report on one phase of the broader study.

* Reg. U.S. Pat. Off.
† Ordnance Corps, Plastics Laboratory, Picatinny Arsenal, Dover, N. J.

Test Methods

Included here are complete data on tensile modulus of elasticity, elongation at break, ultimate tensile strength, work to produce failure,

Table I—Description of Plastic Materials Tested

Code No.	Material	Classification MIL-P-15035A	Description
	I. THERMOSETTING MATERIALS		
	A. Thermosetting, Laminated		
	a. Glass Fabric Base		
310	Laminated melamine, glass fabric base	GMG	Sheet, glass fabric base, laminated arc-resistant material
328	Laminated phenolic, glass fabric base	NEMA G-1	Representative, medium glass fabric laminate, heat resistant
350	Laminated silicone, glass fabric base	GSG	Medium glass fabric base laminate (Dow Corning), DC-2103
	b. Paper Base		
315	Laminated melamine, asbestos paper base	NEMA A	Representative asbestos paper base laminate
320	Laminated phenolic, paper base	PBG	Representative paper base laminated sheet; 40% phenolic resin
321	Laminated phenolic, alpha-cellulose paper base	PBE	Alpha-cellulose paper base laminate; maximum moisture resistance, minimum cold flow, 60% resin
325	Laminated phenolic, alpha-cellulose paper base	PBG-P	Alpha-cellulose paper base laminate; treated with penetrating and laminating resin; punching stock

Table I continued on p. 120.

and Izod impact strength at 77, 10, −40, and −65° F. for 56 different rigid plastics. The plastics are representative of the major classes of rigid plastics that were commercially available at the time this project was started. In classifying a plastic as "rigid" its elongation under tensile stress was taken as the criterion. Plastics with less than 100% elongation at tensile failure when tested at the rates of loading employed at 77° F. were classified as "rigid." The 56 materials investigated are described in Table I.

Tensile Properties—The tensile values were obtained on the 10,000-lb. range of a 50,000-lb. capacity Tinius-Olsen Plastiversal testing machine. Load-elongation graphs were automatically recorded to the point of specimen failure using Baldwin Models PS-6, PS-7, and PS-8 Microformer-type plastics extensometers, coupled to a Baldwin Microformer-type recorder. A visual pacer and manual speed control were used to maintain loading at a constant rate of load increase. The separable extensometers had initial gage lengths of 2 in., and magnifications on the chart of from 2 to 200 were obtainable. Self-aligning wedge grips with file insert faces were used in all tests, and the specimens were aligned carefully in the grips to obtain axial loading as nearly as possible.

Determinations in tension for this investigation were made using a constant rate of load increase of 2500 p.s.i./min., with the exception of the determination for four laminated thermosetting materials with very high tensile strengths (code

Table I—Description of Plastic Materials Tested, con't.

Code No.	Material	Classification MIL-P-15035A	Description
		c. Cotton Fabric Base	
322	Laminated phenolic, fabric base	FBI NEMA L	Representative fabric base laminate; 4-oz. fabric base, 48 to 54% resin
323	Laminated phenolic, fabric base	FBE NEMA LE	Representative electric grade; 4-oz. fabric base, high resin content; fabric thoroughly dried; high moisture resistance
324	Laminated phenolic, fabric base	FBM NEMA C	Representative high impact strength laminate; 12-oz. fabric base, 40% resin
Code No.	**Material**	**Classification MIL-P-14A**	**Description**
		B. Thermosetting, Molded	
		a. Phenolics	
221	2-Step resin, woodflour filled	CFG ASTM 2	General-purpose material
228	2-Step resin, woodflour filled, long flow resin	CFG ASTM 2	General-purpose material
230	Modified resin	CFG ASTM 2	Similar to No. 221 general purpose
222	2-Step resin, cotton flock filled	CFI-5 ASTM 3	Improved impact strength; without hand pelletir.g
227	1-Step resin, cotton flock filled	CFI-5 ASTM 3	Improved impact strength; good resistance to high humidity and elevated temperatures
229	1-Step resin, cotton flock filled, high resin-to-filler ratio	CFI-5 ASTM 3	Good moisture resistance and flexural strength
223	2-Step resin, cotton fabric filled	CFI-20 ASTM 5	General purpose, high impact strength
224	2-Step resin, cord filled	CFI-40 ASTM 6	Maximum impact strength
220	2-Step resin, mineral filled	MFH ASTM 10	Heat and moisture resistant, good dimensional stability
234	2-Step resin, nylon filled	———	Good electrical properties, low modulus of elasticity
235	Phenolic resin, modified with acrylonitrile rubber, cotton flock filler	———	Toughness and shock resistance of fabric filled material
		b. Miscellaneous	
260	Urea-formaldehyde	———	Standard material, alpha-cellulose filled, general purpose
210	Melamine-formaldehyde	———	Cellulose filled, electrical grade
211	Melamine-formaldehyde	ASTM 1	Alpha-cellulose filled, general purpose
270	Polyester molding composition	———	Clay-mica filler, good electrical characteristics, high heat resistance, low moisture absorption
		C. Thermosetting, Cast	
		Miscellaneous	
120	Phenol-formaldehyde	ASTM 1	Mechanical and chemical grade, opaque
140	Polydiallyl diethylene glycol dicarbonate	———	Representative of type

Table I continued on p. 122.

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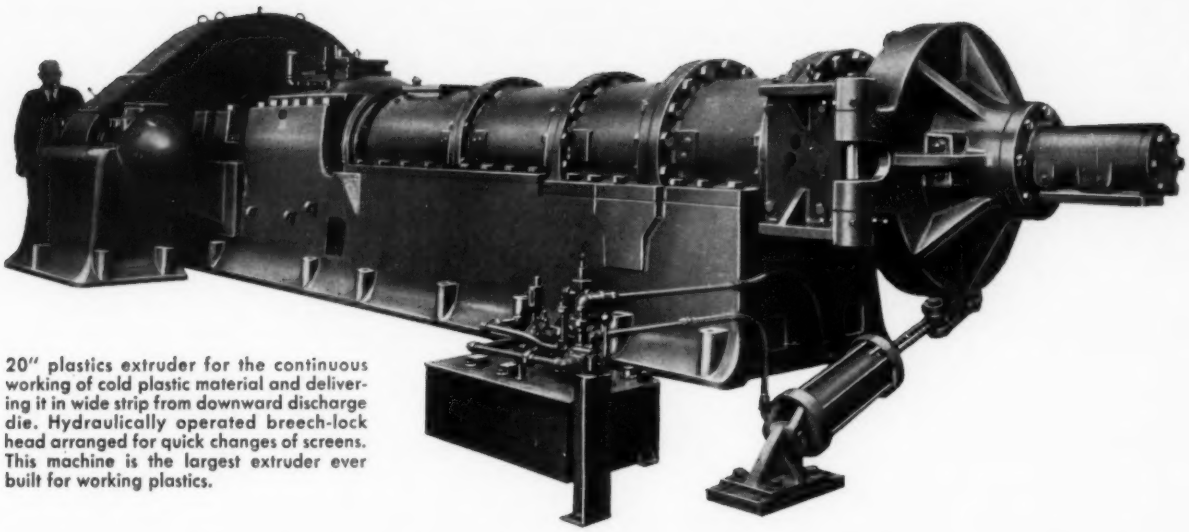
Nos. 310, 320, 328, and 350); for practical reasons, a rate of 8000 p.s.i./min. was used for these latter materials. The tests would have required 10 to 15 min. per specimen with these materials at 2500 p.s.i./min., but required less than one-third as long at 8000 p.s.i. per minute.

Testing at constant rate of load increase rather than at constant rate of elongation had a further advantage in that it permitted testing all of these materials with only two different rates. Testing at constant

Table I—Description of Plastic Materials Tested, con't.

Code No.	Material	Classification Flow	Description
	II. THERMOPLASTIC MATERIALS		
	A. Cellulose Acetate		
510	General purpose, hard	H2	74% normal acetate, 26% mixed phthalate plasticizer[a]
511	General purpose, medium soft	MS	67.5% normal acetate, 32.5% mixed phthalate plasticizer[a]
512	Water resistant, hard	H2	68.75% normal acetate, 20.75% mixed phthalate plasticizer[a], 10.5% triphenyl phosphate plasticizer
513	Water resistant, medium soft	MS	62.5% normal acetate, 25% mixed phthalate plasticizer[a], 12.5% triphenyl phosphate plasticizer
514	Improved water resistance, hard	H2	74% high acetyl acetate, 26% mixed phthalate plasticizer[a]
515	Improved water resistance, medium soft	MS	67.5% high acetyl acetate, 32.5% mixed phthalate plasticizer[a]
516	Maximum water resistance, hard	H2	68.75% high acetyl acetate, 20.75% mixed phthalate plasticizer[a], 10.5% triphenyl phosphate
517	Maximum water resistance, soft	MS	62.5% high acetyl acetate, 25% mixed phthalate plasticizer[a], 12.5% triphenyl phosphate
	[a] Mixed phthalate plasticizer is made up of dimethyl phthalate and diethyl phthalate.		
	B. Cellulose Acetate Butyrate		
540	General purpose, hard	H2	Sebacic acid ester plasticizer, low
541	General purpose, medium soft	MS	Sebacic acid ester plasticizer, medium
542	Maximum water resistance, minimum plasticizer volatility, hard	H2	Phosphoric acid ester plasticizer, low
543	Maximum water resistance, medium soft	MS	Phosphoric acid ester plasticizer, medium
544	Low temperature resistant, medium soft	MS	Adipic acid ester plasticizer, medium
545	Low temperature resistant, hard	H2	Adipic acid ester plasticizer, low
	C. Cellulose Propionate		
560	Only composition available, hard	H2	Low plasticizer content
561	Only composition available, medium soft	MS	Medium plasticizer content
	D. Ethyl Cellulose		
570	General purpose, hard	——	90% K100 ethyl cellulose, 7% Dow V2 resin, 3% triphenyl phosphate
571	General purpose, medium soft	——	80% K100 ethyl cellulose, 14% Dow V2 resin, 6% triphenyl phosphate
572	Nitroglycerine resistant, high impact	——	77% N100 ethyl cellulose, 23% Cerisen
573	General purpose, hard	——	90% K100 ethyl cellulose, 7% Dow V2 resin, 3% tricresyl phosphate
574	General purpose, soft, improved water resistance	——	80% K100 ethyl cellulose, 14% Dow V2 resin, 6% tricresyl phosphate
	E. Cellulose Nitrate		
110	Cellulose nitrate, sheet, general purpose material	——	Contains 23% camphor
	F. Polystyrene		
640	Polystyrene, general purpose	——	100% styrene polymer, heat resistant
660	Styrene-acrylonitrile copolymer	——	Copolymer with higher resistance to heat and solvents
661	Styrene-acrylonitrile copolymer	——	Similar to 660; was added because No. 660 is not produced any more
662	Polystyrene, modified	——	Polystyrene mixed with acrylonitrile rubber, high impact strength
663	Polystyrene, modified	——	Polystyrene mixed with acrylonitrile rubber, medium impact strength
	G. Polymethyl Methacrylate		
670	General purpose molding material	——	100% polymer, molded
150	Heat resistant cast sheet	——	100% polymer, cast, heat resistant



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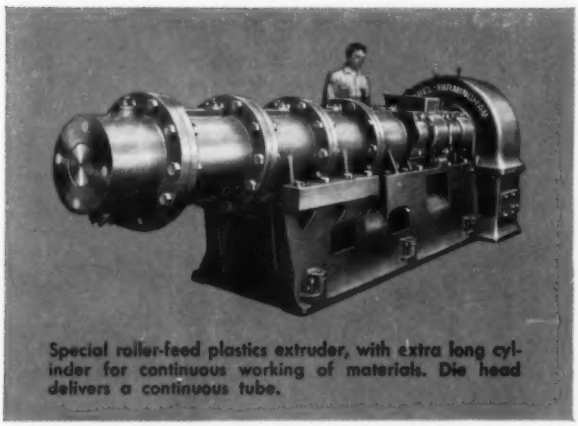

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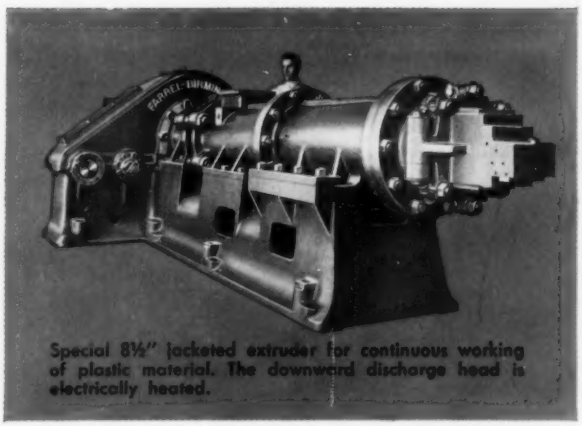
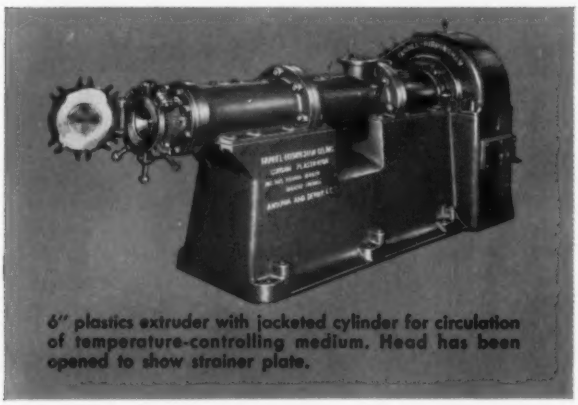


Special 8½" jacketed extruder for continuous working of plastic material. The downward discharge head is electrically heated.



6" plastics extruder with jacketed cylinder for circulation of temperature-controlling medium. Head has been opened to show strainer plate.

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Table II—Summary of Changes in Properties With Decreasing Temperatures

Changes from values at 77° F. (Where more than one material was tested in a class, the least and the greatest changes are given.)

	Tensile			Elongation			Modulus			Work to produce failure			Impact		
	−65° F.	−40° F.	10° F.	−65° F.	−40° F.	10° F.	−65° F.	−40° F.	10° F.	−65° F.	−40° F.	10° F.	−65° F.	−40° F.	10° F.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
I. THERMOSETTING															
A. Laminated															
a. *Glass fabric base*	+13	+15	+1	+23	+10	−1	−26	−32	−11	+32	+40	+8	+27	+17	+13
	+35	+17	+7	+44	+26	+5	+10	+12	+75	+86	+43	+28	+39	+31	+24
b. *Paper base*	0	+4	+2	−32	−26	−17	+20	+27	+10	−39	−17	−17	+4	+2	+4
	+20	+29	+7	−45	−34	−23	+72	+53	+41	−46	−37	−22	−17	−17	−8
c. *Cotton fabric base*	+12	+10	+5	−34	−30	−4	+34	+25	+12	−13	−22	−2	−30	−21	−11
	+18	+17	+10	−40	−40	−21	+56	+40	+19	−33	−31	−17	−35	−33	−22
B. Molded															
a. *Phenolics*															
1. *Woodflour*	+4	0	0	−21	−7	−2	+33	+24	+17	−7	−6	0	0	0	0
	+14	+10	+10	−25	−18	−15	+39	+29	+25	−32	−18	−17	0	0	0
2. *Cotton flock*	0	0	+5	−23	−14	−10	+34	+26	+27	−5	−9	−4	0	0	0
	+22	+11	+11	−30	−25	−25	+50	+31	+63	−20	−16	−16	0	0	0
3. *Fabric or cord*	+15	+10	+5	−4	−9	0	+43	+17	+20	0	0	0	−29	−30	−19
	+30	+14	+7	−18	−25	−6	+43	+28	+36	0	0	0	−42	−35	−20
b. *Urea-formaldehyde*	−10	−10	−4	−36	−32	−18	+39	+30	+15	−39	−38	−18	0	0	0
c. *Melamine*	−14	−11	−11	−40	−37	−29	+48	+36	+29	−47	−60	−22	0	0	0
d. *Polyester molding*	−15	+46	+34	−33	+27	+20	+40	−28	−16	+30	+70	+52	+20	0	0
C. Cast															
a. *Phenol-formaldehyde*	+26	+60	+36	−38	−10	−9	+67	+38	+31	−30	+28	0	−30	−30	−10
b. *Diallyl diethylene glycol dicarbonate*	+11	+11	+19	−47	−43	−17	+85	+65	+35	−36	−34	0	−16	0	+25
II. THERMOPLASTIC															
A. Cellulose acetate	+83	+72	+39	−70	−59	−17	+120	+67	+24	−31	−21	−17	−77	−77	−70
	+230	+194	+120	−99	−84	−72	+440	+210	+85	−85	−78	−49	−98	−97	−88
B. Cellulose acetate butyrate	+57	+82	+27	−40	−30	−19	+48	+38	+13	−8	−19	0	−63	−54	−54
	+124	+136	+63	−83	−74	−60	+95	+72	+29	−77	−63	−56	−94	−91	−87
C. Cellulose proprionate	+117	+95	+38	−64	−44	−33	+75	+51	+27	−39	0	−23	−49	−77	−58
	+135	+111	+55	−68	−54	−52	+94	+58	+58	−44	−22	−50	−92	−89	−75
D. Ethyl cellulose	+44	+33	+9	−51	−47	−22	+92	+82	+64	−33	−50	−8	−62	−58	−39
	+330	+260	+140	−79	−75	−55	+305	+300	+98	−69	−65	−72	−92	−89	−64
E. Cellulose nitrate	+110	+84	+38	−62	−59	−32	+85	+62	+21	−37	−37	−11	−76	−69	−43
F. Polystyrene															
a. *Polystyrene and copolymers with acrylonitrile*	+29	+24	+17	0	0	0	+17	+11	+6	+30	+26	+12	+4	+2	0
	+37	+41	+22	−23	−17	−17	+32	+31	+18	−9	−20	−16	−27	−20	−7
b. *Polystyrene, modified with nitrile rubber*	+83	+83	+46	−63	−50	−32	+45	+30	0	−36	−9	−11	−72	−72	−54
	+130	+130	+71	−82	−79	−52	+63	+48	+3	−82	−80	−40	−78	−79	−60
G. Polymethyl methacrylate	+34	+34	+24	−58	−52	−39	+90	+57	+33	−50	−42	−30	0	0	0
	+58	+58	+40	−64	−57	−43	+92	+63	+34	−63	−55	−38	−11	+9	+11

rate of elongation would have required several different rates of testing in order to cover practicably the variety of materials involved.

It is wise to avoid the application of widely differing rates in comparative testing of plastics, since these materials are known to be highly rate-sensitive. In addition, many of the specific applications for plastics in the Ordnance Corps involving loading at approximately this rate are applications that are analyzable according to rate of load increase rather than according to rate of extension. In fact, preliminary survey indicates that a majority of applications at this approximate loading rate are so analyzable.

The tensile machine was located in a room in which the temperature was maintained at 77 ± 2° F. and the humidity at 50 ± 2 percent. For tests at temperatures below 77° F., the testing machine was equipped with an insulated housing which enclosed the tension grips and specimen and fitted between the screws of the testing machine. Low-temperature air, precooled by passing over solid carbon dioxide, was circulated in the cabinet; temperature controls maintained the required temperature within ± 2 degrees F. All specimens were conditioned in this cabinet at test temperature for 2 hr. before the test. No attempt was made to control the humidity at the low temperatures.

The basic method for the tensile determinations in this investigation was Method 1011, Federal Specification L-P-406a, which was strictly adhered to except for the modification in the rate of load application as discussed above.

Five specimens, chosen at random from several hundred fabricated under uniform conditions were tested at each temperature, and the arithmetical averages are reported. Statistical limits were calculated by the method described in the ASTM

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Just for example, see how Cabflex DDP and Cabflex DDA can replace DOP and DOA to advantage where extraction by soapy water is the consideration.

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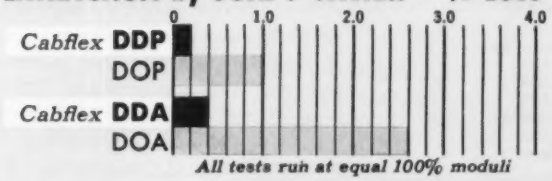

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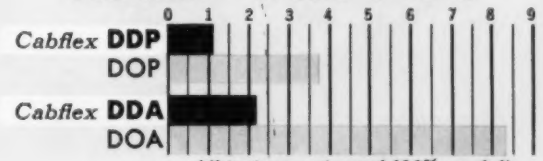
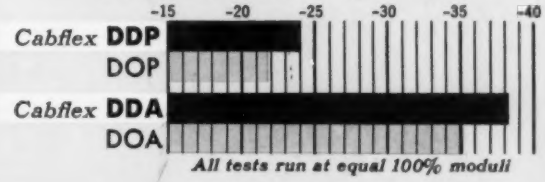


All tests run at equal 100% moduli

CLASH and BERG — T_f — °C.



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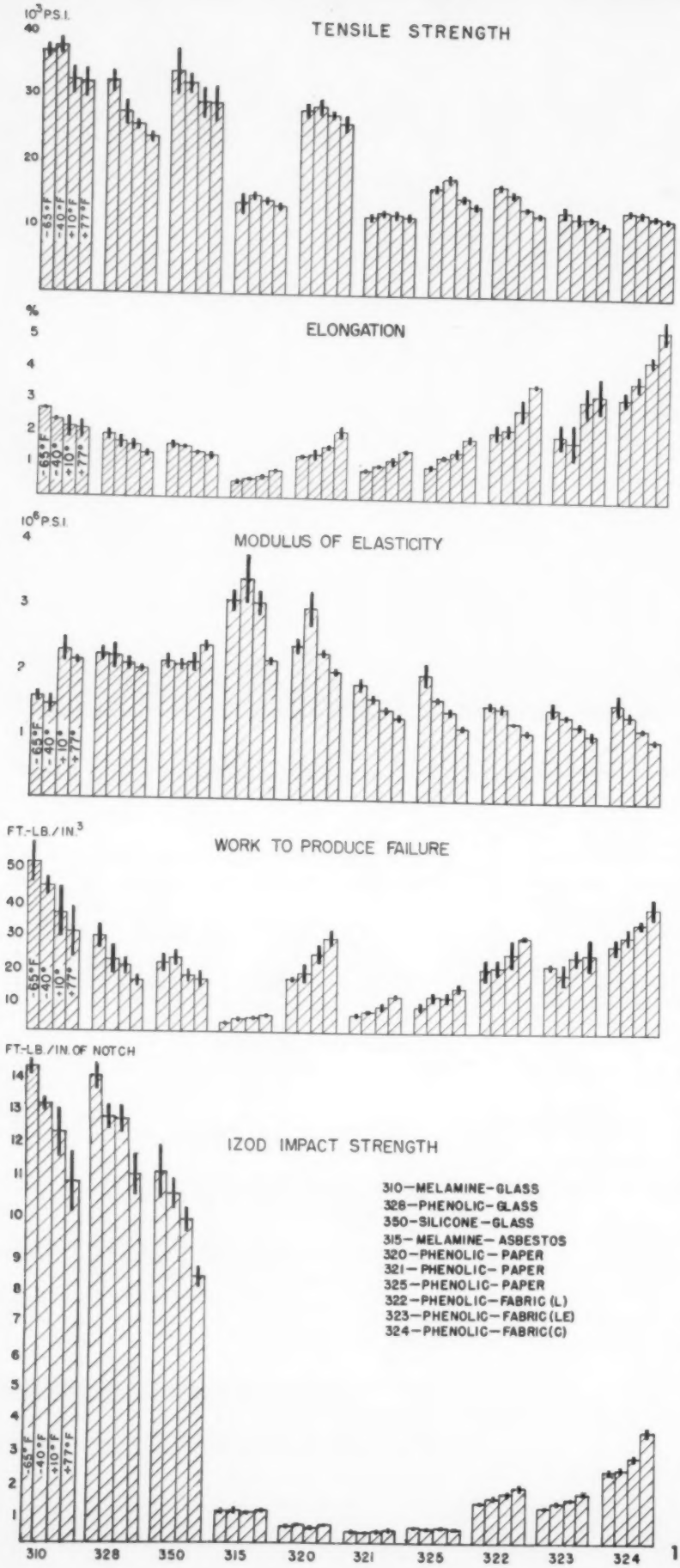
CABOL®100 (hydrocarbon oil plasticizer)



Manual on Presentation of Data, Supplement-A.

Impact Strength—A Baldwin-Southwark pendulum-type impact machine, based on a design by Bell Telephone Laboratories and conforming for accuracy to Federal Specifications L-P-406 and ASTM D 256-41T, was used for obtaining the Izod impact data. Depending on the strength of the individual materials, either a 1- or a 2-ft.-lb. hammer was used.

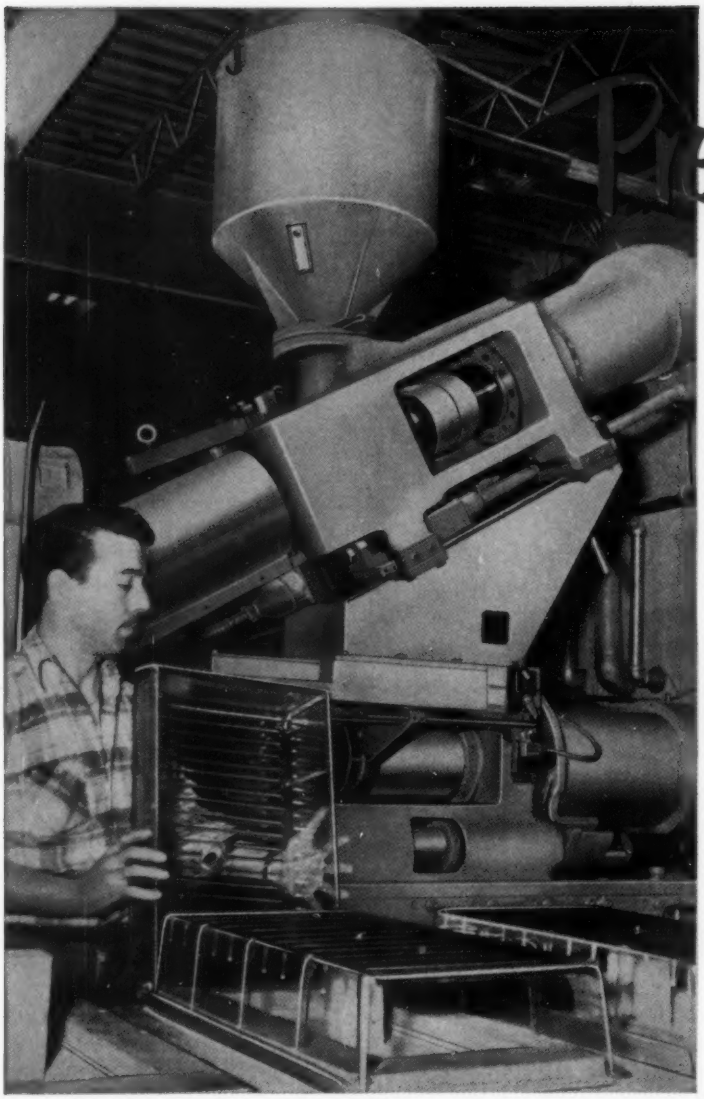
Tests at 77° F. were performed in a room kept continuously at 77 ± 2° F. and 50 ± 2% relative humidity. For tests at lower temperatures the entire apparatus was placed in a heavily insulated cabinet provided with suitable multi-paned windows, arm holes, and interior lighting. Air precooled by solid carbon dioxide was circulated in the cabinet, and the temperature was maintained by controls at the required level, with variations of less than ± 2 degrees F. Specimens were conditioned in this cabinet at test temperature for 2 hr. before the test.

Individual values were read from the dial of the impact testing machine and were recorded. After corrections had been made for frictional losses, impact strength in foot-pounds per inch of notch was calculated by dividing the energy in foot-pounds expended in the individual test by the actual dimension in inches along the notch of the specimen. Averages and limits were calculated as described in Supplement 4 of the ASTM Manual on Presentation of Data.

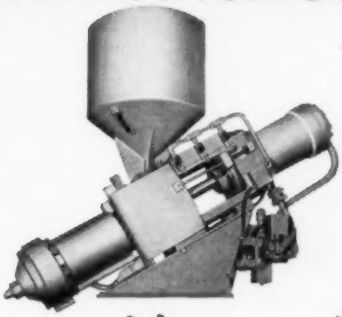
Method No. 1071, Federal Specification L-P-406a, was followed in the determination of the reported impact strength values. Several hundred specimens were produced from each material, and ten were taken at random for the tests at each of the specified temperatures.

Test Conditions—The test temperatures of 77, 10, −40, and −65° F. were chosen for the following reasons. The temperature 77° F. was chosen because it was the standard national temperature for testing plastics at the time that this project was initiated. The tempera-

Fig. 1—Physical properties of several thermosetting laminates at four temperatures (see Table I, pp. 119-120, for detailed description of the materials)



WATSON-STILLMAN Preplasticizers



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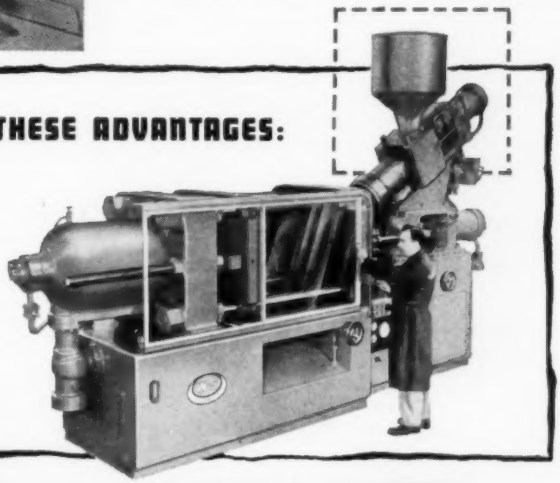

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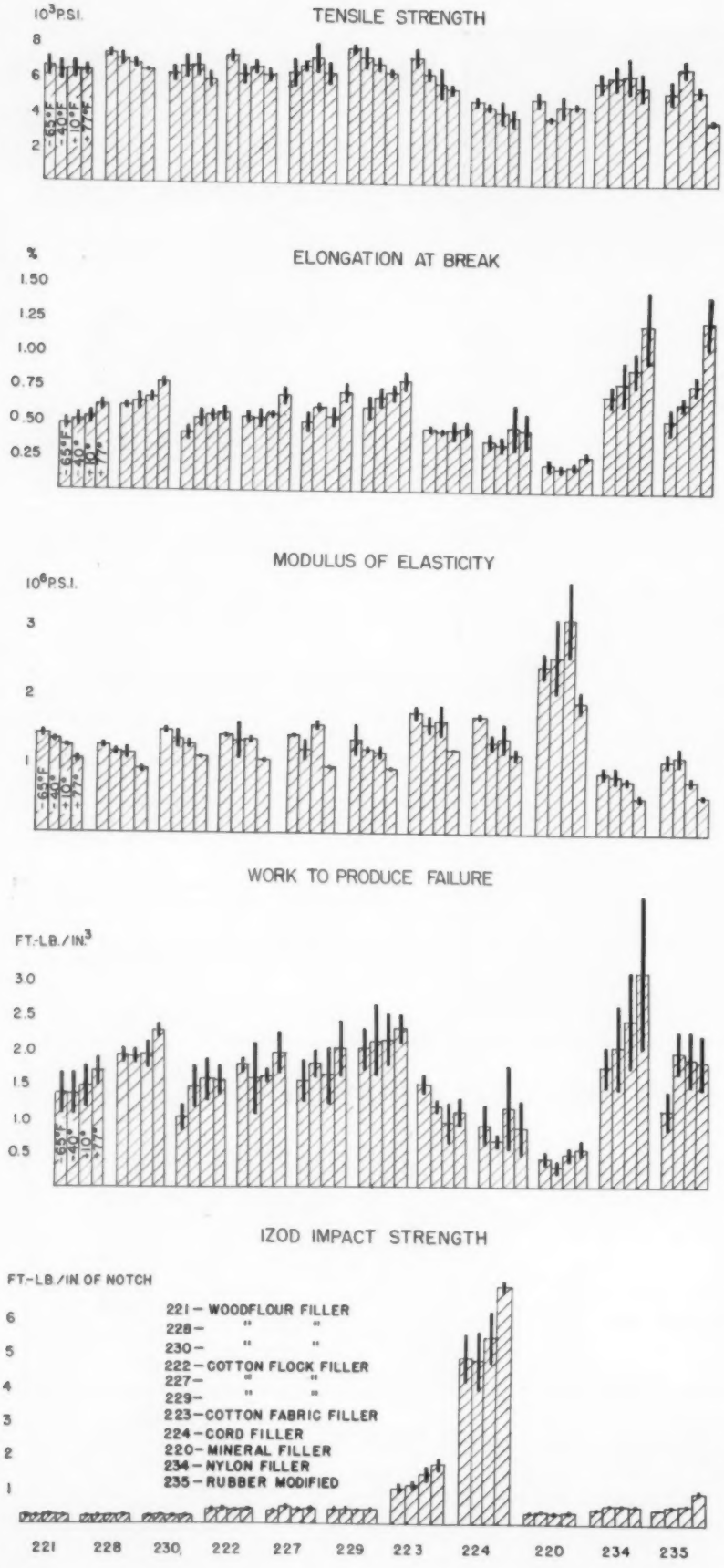

tures −65 and −40° F. were chosen because they represent low temperatures at which specific items of Ordnance Corps materiel must function. The temperature 10° F. was chosen rather than a temperature half way between −40 and 77° F. because the effects of low temperature increase more rapidly with decreasing temperature in this region, and because 10° F. represents moderately severe winter weather in most climates.

At 77° F. the relative humidity was controlled at 50 ± 2 percent. No attempt was made to control or record the relative humidity at lower temperatures.

The data on the different mechanical properties of rigid plastics were obtained under uniform test conditions, and on materials and test specimens produced under uniform conditions. Such data, therefore, should lend themselves to the application of statistical methods. When such methods were applied, rather large deviations were obtained.

The data illustrated in the graphs are both the average and the deviation. This latter gives the value range within which the average will be found nine times out of ten.

Attention is called to the fact that the modulus of elasticity is determined with a relatively low degree of accuracy on plastics, because the load-deformation curve employed seldom has a straight initial portion.

Izod impact values are included only as reference data on the materials tested. Insofar as is known, these data have no utility for design purposes. In fact, efforts to correlate them with performance at high rates of loading have not been successful. Accordingly, Izod impact values should not be used to predict the relative impact performances at rates of loading different from those encountered in the test meth. 4. The other properties reported are determined with much greater precision.

Test Results

The results obtained were in general as expected. Values of tensile strength, proportional limit, and

Fig. 2—Physical properties of molded phenolic materials at four temperatures (see Table I, p. 120, for a detailed description of the materials)

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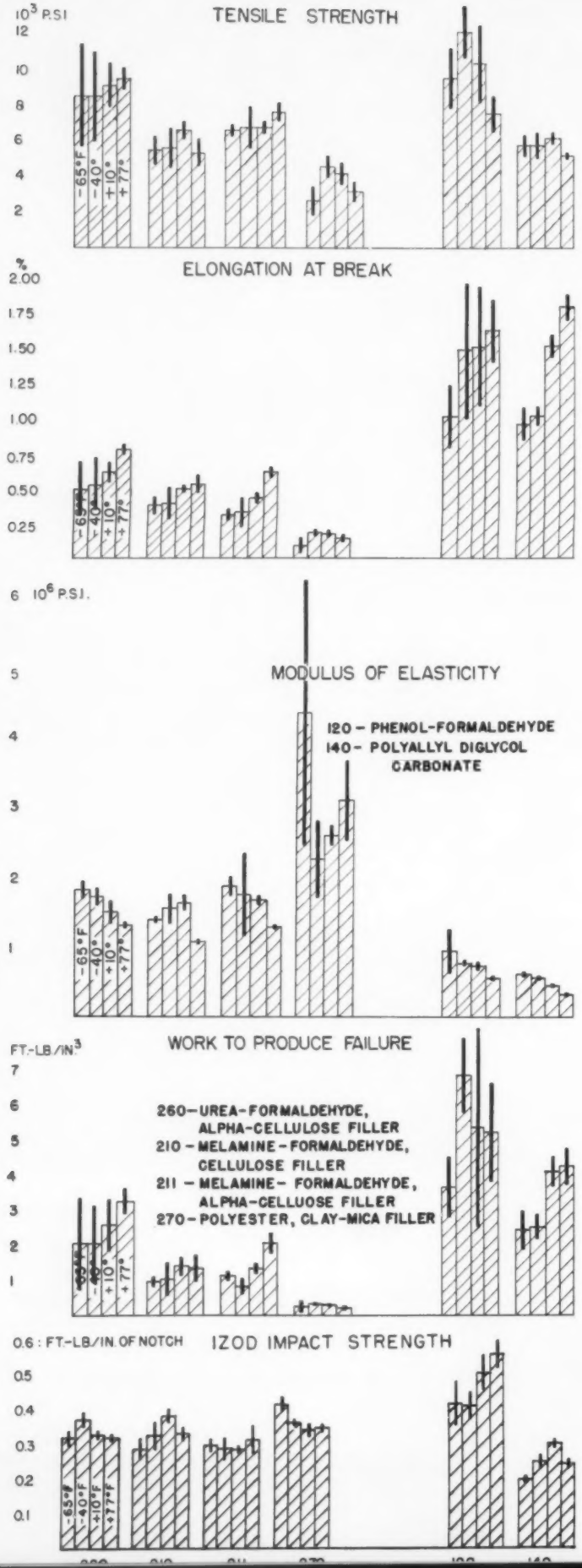

modulus of elasticity increased with decreasing temperature. Elongation and work to produce failure decreased with a lowering of temperature, as did impact strength. This, however, is only a general, qualitative statement. Based upon percentages, there were tremendous differences in the temperature dependency of the properties of the different plastics. In addition, a few materials behaved contrary to the general trend because of either the peculiarity of their structure or the addition of inorganic fillers.

The data obtained and the statistically computed limits of uncertainty appear in graphical form. Table II, p. 124, offers an over-all picture, giving the changes from values at 77° F., expressed in percentages. The individual types of materials are discussed below.

Laminates—The test results for the thermosetting laminates are shown in Fig. 1, p. 126. The moduli of elasticity of the laminates increased with decreasing temperatures. Of all the thermosetting materials, the highest tensile strengths were obtained with this group and of these, the glass fabric laminates were the strongest. As the temperature was lowered, all laminates showed an increase in tensile strength. This trend was usually arrested between −40 and −65° F., at which temperatures the effect of embrittlement had a determining influence (slight strength reduction).

The different types of reinforcing materials used in these laminates had a pronounced effect upon elongation and impact strength and upon their variations with temperature. The combination of glass fabric and thermosetting resins produced the most unexpected results. These materials showed an increase in elongation as well as in impact strength with decreasing temperatures. The increase in elongation was small and inconsequential, but the increase in impact strength was substantial and significant. This increase in impact strength with decreasing temperatures is an outstanding property of the glass fabric laminates.

Elongation of paper and cellulose

Fig. 3—Physical properties of molded and cast thermosetting plastics at four temperatures (see Table I, p. 120, for description of the materials)

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The short injection stroke of the Injection Plunger—operating upon homogeneously plasticized material at the nozzle end of the Heating Cylinder—produces a direct displacement of material and does not have to transmit pressure through layers of granular and semi-plasticized material.

The special 'finned' design of Heating Cylinder gives homogeneous plasticizing at high rates and is 'pre-filled' during the molding closing stroke.

Fig. 1.—FORWARD POSITION. Here the prefilling ring has drawn back clear of the feed and a fresh charge of material passes into the cylinder; the plunger remains forward.

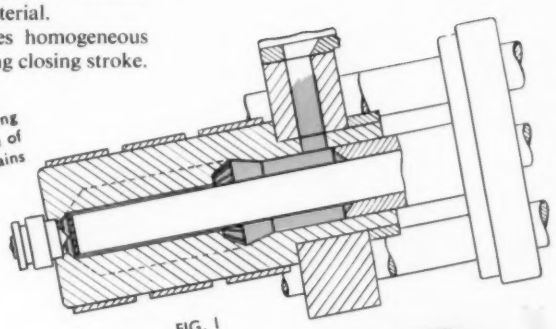

FIG. 1

Fig. 2.—BACK POSITION. After the new charge has been drawn in, the prefilling ring travels forward, compressing the material at the same time as the plunger moves back ready for its forward injection stroke. The nozzle is designed to restrict the escape of material during this action.

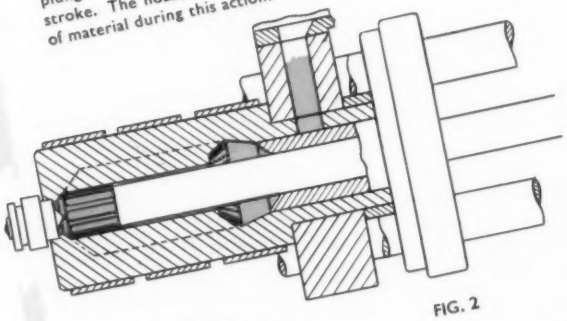

FIG. 2

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INJECTION MOLDING MACHINE

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CUTS MOLDING TIMES AND COSTS

SIMPLE TOOLING ENABLES RAPID MARKETING

RAPID DELIVERY

SPECIFICATION

Approximate weight of material plasticized per hour (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2.074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mold opens (adjustable)	6—9 in.
Maximum die space	7½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mold	15 sq. in.
Size of die plates	16 x 10 in.

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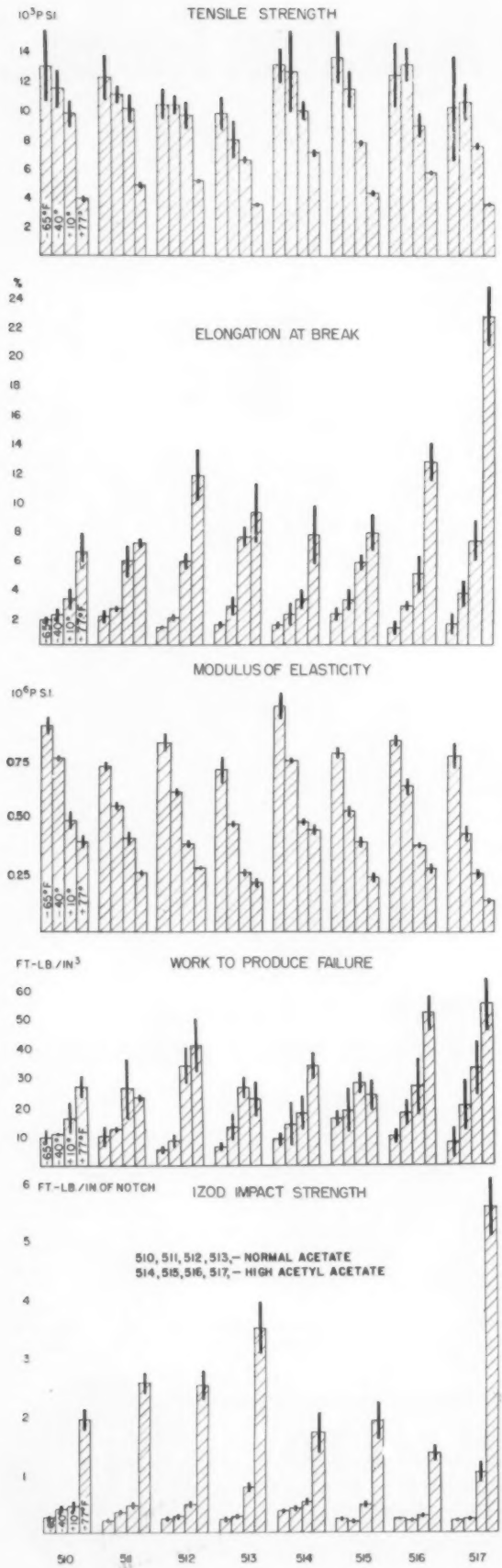

Fig. 4 (left, this page)—Properties of cellulose acetate plastics at four temperatures (see Table I, p. 122, for detailed description of the materials)

Fig. 5 (left-hand side, opposite page)—Properties of cellulose acetate butyrate and cellulose propionate plastics at four temperatures (see Table I, p. 122, for detailed description of the materials)

Fig. 6 (right-hand side, opposite page)—Properties of ethyl cellulose and cellulose nitrate plastics at four temperatures (see Table I, p. 122, for description of the materials)

fabric laminates decreased normally with temperature, the fabric base laminates giving the higher values at all temperatures. Impact strength of paper base laminates remained essentially constant down to −65° F., while for fabric base laminates a normal decrease was observed.

Work to produce failure increased with lower temperatures in the case of glass fabric laminates and decreased for all others.

Phenolic Molding Materials—The test results for the phenolic molding materials are shown in Fig. 2, p. 128. The molded phenolics performed essentially as expected of plastics in general. The composition modified with rubber and the materials that contained special fillers, such as nylon or mineral fillers, showed slight deviations from the general trend, but the deviations were not significant enough to warrant discussion.

The most noteworthy feature of the behavior of molded phenolics was the relative insensitivity of the observed impact strengths to temperature. Only two materials, those with fillers of macerated cotton fabric and cord, showed normal decreases in impact strength with decreases in temperature.

Other Thermosetting Molded and Cast Materials—The test results for molded melamine, urea, and polyester materials are shown in Fig. 3, p. 130. Their performances were similar. Modulus, elongation at break, and work to produce failure all varied normally with temperature. Impact strengths were very low and were essentially unaffected by temperature. Tensile strengths were nearly unaffected by temperature except in the case of the polyester.

The influence of temperature upon the properties of cast plastics was normal (Fig. 3). This is to be expected, as these materials are 100% cross-linked polymers containing no filler or modifying materials.

Thermoplastics—In general, it was expected that the temperature sensitivity of thermoplastic materials would be greater than for thermosetting and this expectation was borne out.

Considering specific materials, unmodified cellulose esters are so brittle that almost no practical application for such materials can be found. However, the incorporation

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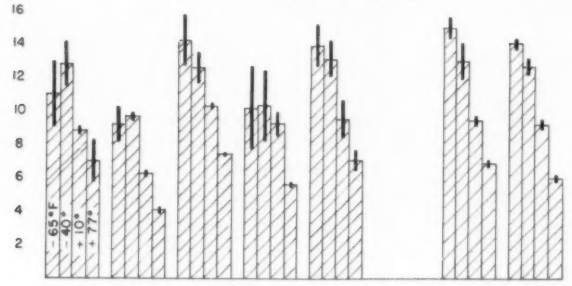
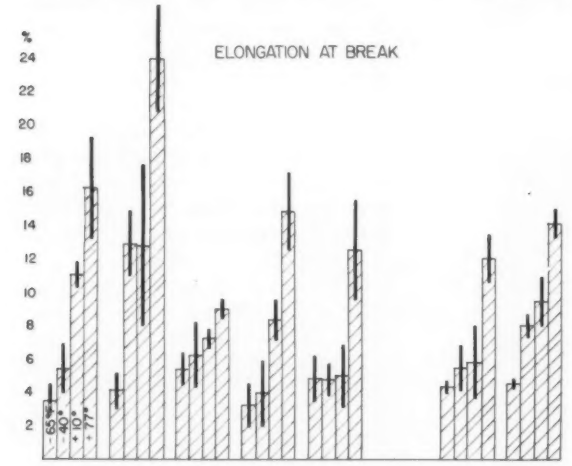
TENSILE STRENGTH

10^3 P.S.I.



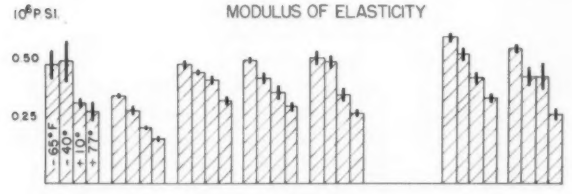
ELONGATION AT BREAK

%



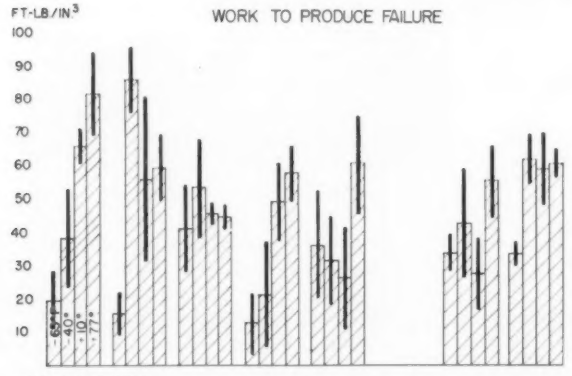
MODULUS OF ELASTICITY

10^6 P.S.I.



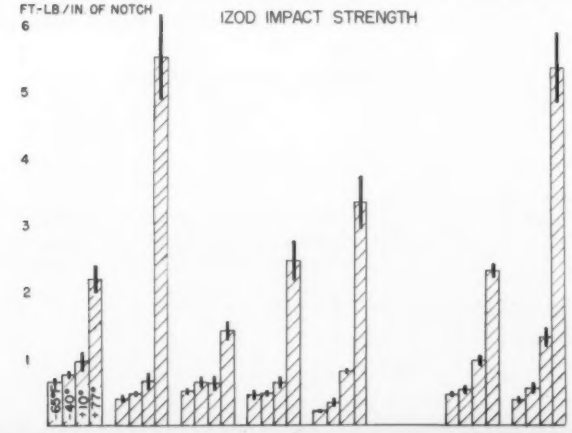
WORK TO PRODUCE FAILURE

FT-LB./IN.^{3}



IZOD IMPACT STRENGTH

FT-LB./IN. OF NOTCH

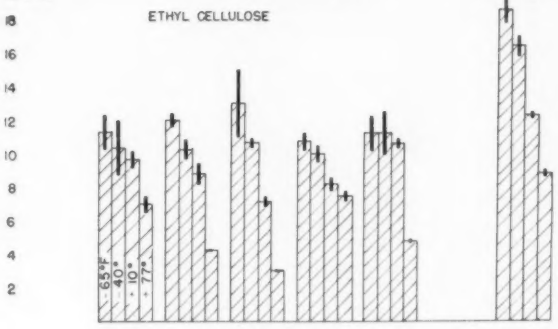


TENSILE STRENGTH

ETHYL CELLULOSE

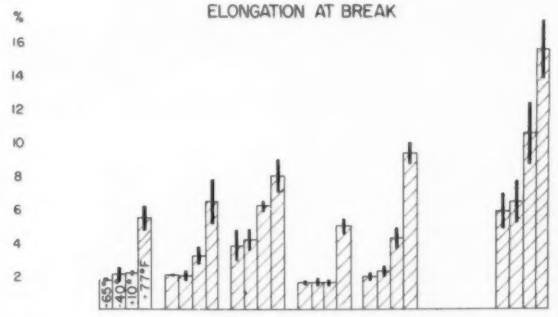
CELLULOSE NITRATE

10^3 P.S.I.



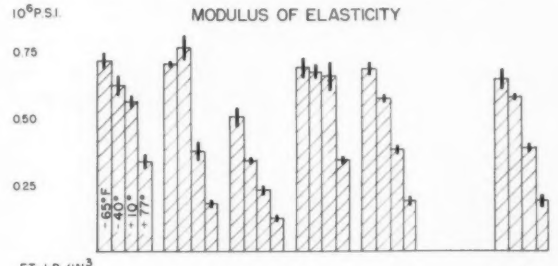
ELONGATION AT BREAK

%



MODULUS OF ELASTICITY

10^6 P.S.I.

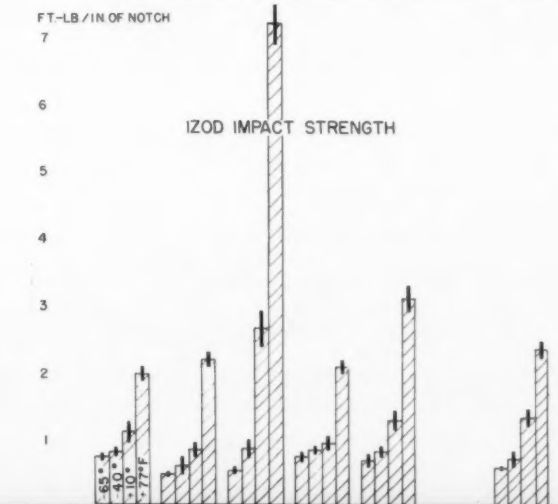


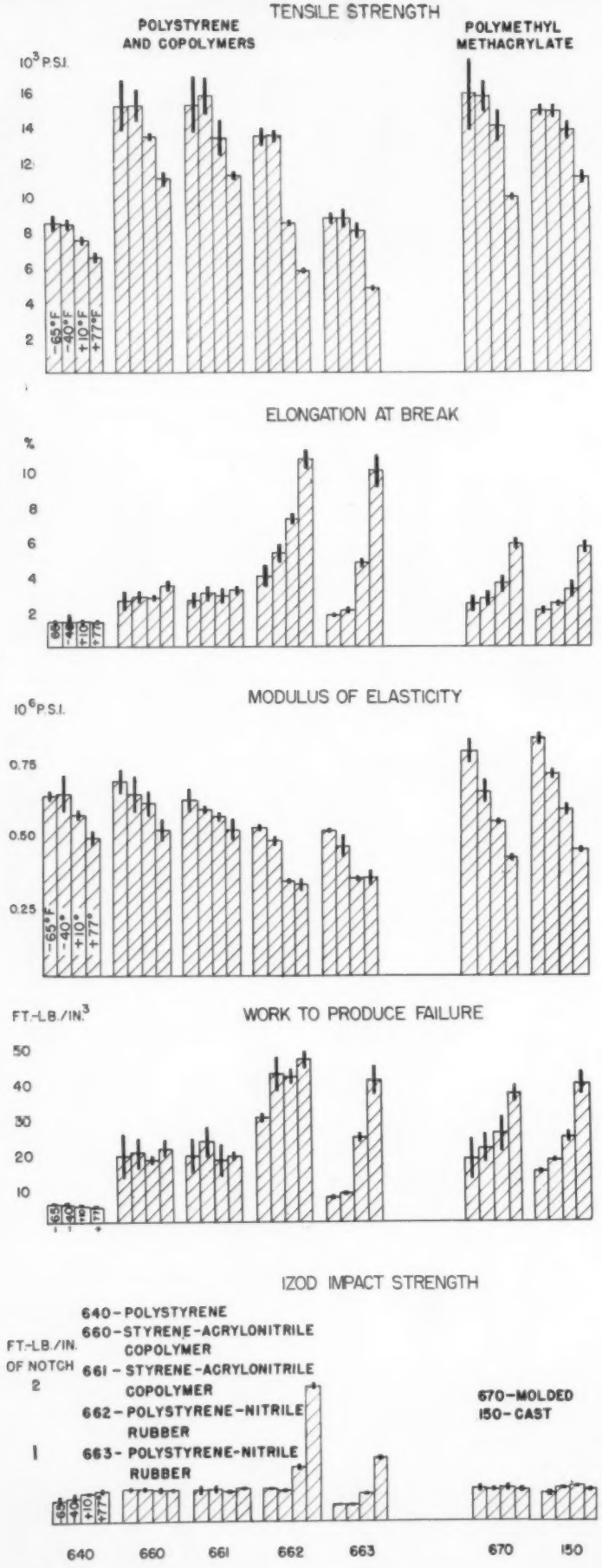
WORK TO PRODUCE FAILURE

FT-LB./IN.^{3}

IZOD IMPACT STRENGTH

FT-LB./IN.OF NOTCH





of plasticizers results in very useful products. Thousands of variations of useful compositions of cellulose acetate plastics are possible, but only a limited number of such compositions meet performance and economic requirements. By choosing a few typical formulations, it has been possible to show the performance that can be obtained with the vast majority of compositions normally in commercial use.

In general, all formulations showed the typical behavior expected of thermoplastics. This behavior consisted of an increase of modulus and tensile strength, and a decrease in elongation, work to produce failure, and impact strength with decreasing temperatures. However, the magnitude of change was markedly influenced by the details of the particular composition.

Cellulosic Plastics—The test results for cellulosic plastics are shown in Figs. 4, p. 132; 5, p. 133; and 6, p. 133. All acetate compositions showed an increase in modulus with decreasing temperatures, the largest increase taking place between −40 and −65° F. This is an indication of progressive embrittlement in this temperature range.

More evidence of embrittlement was obtained by an observation of the changes taking place in elongation. Elongations of from 8 to 24% were obtained at 77° F., depending on the composition, but between −40 and −65° F. elongations were only 2 to 4 percent. Work to produce failure varied with temperature, similar to elongation.

The increase in tensile strength with decreasing temperatures was greater for compositions high in plasticizer content than for those with less plasticizer, even though some of the compositions with low plasticizer content had higher strength at 77° F. For equal amounts of plasticizer, the compositions containing cellulose acetate with high acetyl had higher tensile values over the whole temperature range.

Impact values dropped rapidly between 77 and 10° F., but changed

(*To page* 207)

Fig. 7—Physical properties of styrene and acrylic plastics at four temperatures (see Table I, p. 122, for a description of these materials)

D·D·P

(di-decyl phthalate)

(di-iso-octyl adipate)

D·I·O·P

(di-iso-octyl phthalate)

D·D·A

(di-decyl adipate)

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

Materials

PLASTIC FILM SELECTION. Canadian Plastics *1954*, 41-43, 73 (Nov.). The properties and applications of plastic films used in packaging are reviewed, with emphasis upon the advantageous properties possessed by each. The discussion includes cellophane, cellulose acetate, cellulose acetate butyrate, ethyl cellulose, polyethylene, Pliofilm, saran, vinyls, and polystyrene. The article contains several handy charts including a weight calculator and yield chart, a film selector chart, and a fabrication chart.

SANDWICH MATERIALS FOR HIGH TEMPERATURE USES. I. Katz. Materials & Methods *40*, 92-95 (Nov. 1954). Sandwich type constructions utilizing glass reinforced plastic cores are described; they have proved serviceable in the 300 to 500° F. temperature range. The cores may be of the honeycomb, multiwave, or expanded plastic type. The limited number of resins suitable for such high temperature applications include triallyl cyanurate-modified polyesters, silicones, and certain phenolics. Fabrication techniques, test methods, design, and applications are discussed.

SULFONATION PRODUCTS FROM POLYMERS OF STYRENE AND VINYLTOLUENE. H. H. Roth, Ind. Eng. Chem. *46*, 2435-39 (Nov. 1954). Water-soluble, low-crosslinked sulfonation products of polymers of styrene and vinyltoluene were easily prepared. Mixtures of liquid sulfur dioxide and carbon tetrachloride, when used as the medium for dilute solutions (about 1 to 3%) of the polymer and monomeric sulfur trioxide, were effective in minimizing the sulfone side reaction that normally occurs in other sulfonation processes. The probable extent of the elimination of crosslinking during sulfonation is discussed in the light of the "0.5% water viscosity" variations of the water-soluble products. Polymers of up to 1,000,000 molecular weight were sulfonated with little crosslinking. The sulfone crosslinking was reduced to a negligible value under certain conditions of sulfonation. Products free of crosslinking were more easily made from polymers containing vinyltoluene. As a synthetic gum, the sulfonation products should find use as aqueous thickeners, impregnants, adhesives, textile sizes, and in soil conditioning.

THERMOPLASTIC WATER-SOLUBLE SYNTHETIC GUM. G. K. Greminger, R. W. Swinehart, and A. T. Maasberg. Ind. Eng. Chem. *47*, 156-60 (Jan. 1955). Chemical alteration of cellulose has produced a new modified methyl-cellulose which combines many properties of the organo-soluble cellulose derivatives with the properties of the hydrophylic synthetic gums. This product is non-ionic, surface-active, thermogelling in aqueous solution, and can be formed by heat-fabrication techniques normally possible only with plastic-type compounds. With this mixed ether of cellulose, it is possible to extrude, injection mold, compression mold, or hot cast from non-aqueous solvents a shaped object that is water-soluble.

PREMIXED POWDER FOR SILICONE FOAMS. D. E. Weyer. Materials & Methods, *40*, 102-104 (Dec. 1954). A premixed powder for producing high-temperature silicone foams merely by heating is now available. The foamed plastics obtained are similar in properties to those heretofore made with resins that had to be melted and mixed with a catalyst and blowing agent before being poured into the mold. The new premixed dry powder contains exact proportions of resin, filler, blowing agent, and catalyst. No further processing is necessary. A predetermined amount of powder is poured into a cavity or mold and heated at a selected temperature depending on the density of the foam desired. The density can consistently be held within plus or minus 1 lb./cu. foot. Three types of powder covering three density ranges from 10 to 18 lb./cu. ft. are available. Silicone foams, when foamed in place, will adhere to most metals and glass cloth laminates. Cured silicone foams can be bonded to each other or to other materials, when necessary, with various Silastic adhesive materials which are available in either heat-vulcanizing or room-temperature vulcanizable form.

Molding and Fabricating

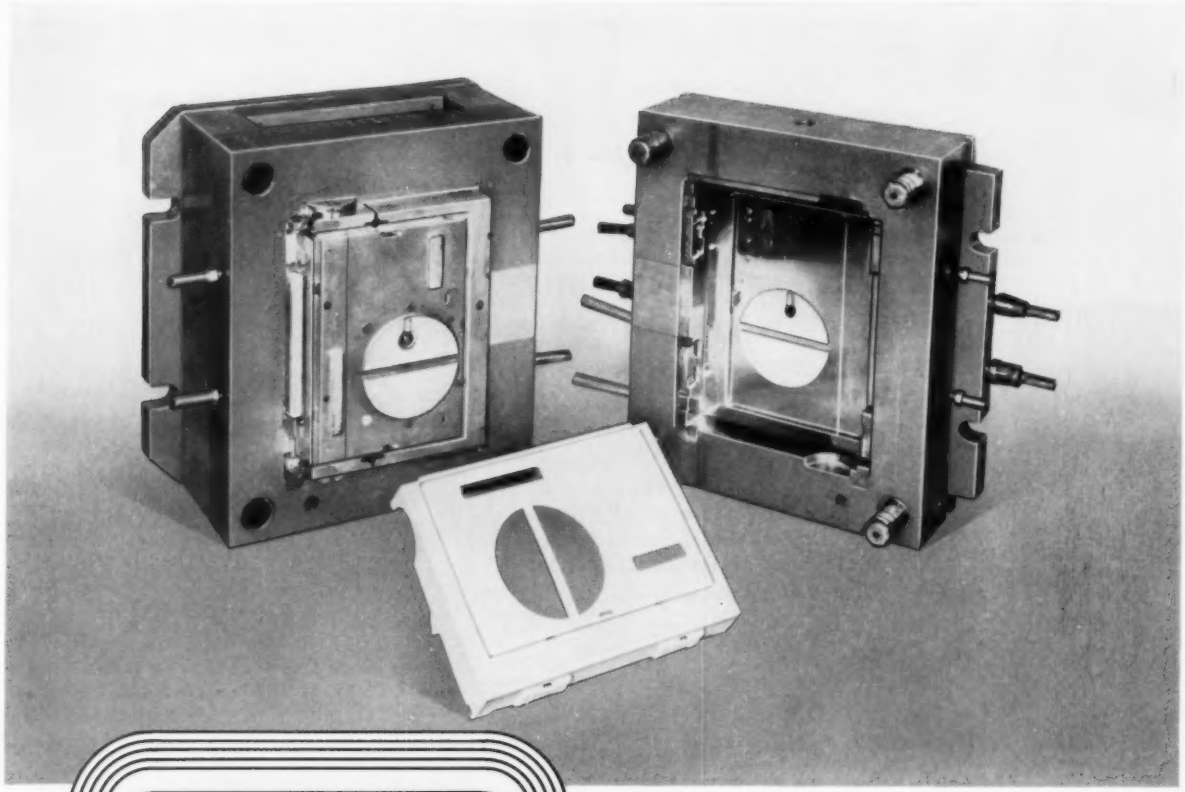
AN ANALYTICAL STUDY OF THE SINGLE SCREW EXTRUDER. C. Maillefer. Brit. Plastics *27*, 394-97 (Oct.); 437-440 (Nov. 1954). A theoretical study is made of the operation of extruders for two cases. In the first case, it is assumed that the thermoplastic material being worked is an incompressible Newtonian fluid; in the second case, it is assumed that the particles have no displacement in relation to one another in the screw thread, as for a dry powder. Equations are derived relating output to pressure and are verified by experiments with oil and with polyethylene plastic material.

Applications

SILICONES IN NAVAL SHIPBOARD ELECTRICAL EQUIPMENT. H. P. Walker and G. M. Van Lear. Ind. Eng. Chem. *46*, 2345-48 (Nov. 1954). Silicone insulation was investigated for possible shipboard applications because of its unique thermal and moisture resistance properties. By utilizing this new family of materials, the electrical designers are able to achieve 30% savings in weight and space. The increased moisture resistance of silicone insulated equipment also results in greater reliability of the equipment. Military specifications have been written to cover silicone materials, as well as cable and equipment utilizing silicones. The availability and utilization of such specifications have done much to allow the military as well as the industrial users to obtain uniform products.

PLASTICS IN BUILDING. Architectural Forum *102*, 120-27 (Jan. 1955). The properties and prices of plastics are compared with those of other building materials and are reviewed

* Reg. U.S. Pat. Off.



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from the viewpoint of their use in building construction. Limitations and possible applications are also considered. Some present applications are described.

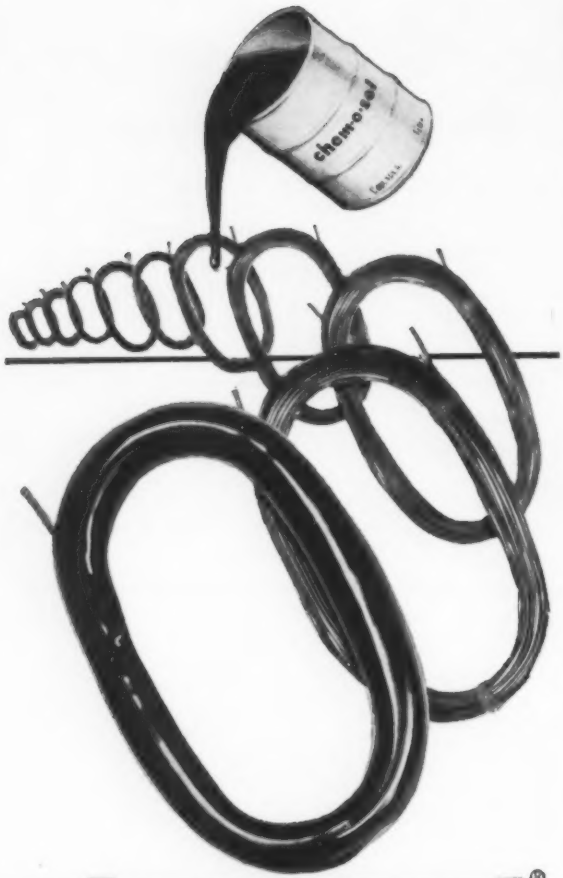
POLYTHENE IN TRANSATLANTIC CABLE. Brit. Plastics *27*, 487 (Dec. 1954). About 1400 tons of polyethylene will be used in the manufacture of the first transatlantic telephone cable, now underway. The use of polyethylene, to which a small proportion of butyl rubber and antioxidant is added to improve its mechanical properties, is for insulating the copper conductor. The processes in the production of the cable are discussed.

POLYSTYRENE MOLDINGS IN INVESTMENT CASTING. Brit. Plastics *27*, 460-63 (Dec. 1954). Recently considerable success has been achieved by the use of injection molded polystyrene instead of wax for making the expendable pattern used in investment casting of metals. Polystyrene can be readily injection molded on conventional equipment and the strength and hardness of the molding greatly reduce breakage and marking prior to investment. The application of this technique to several components of difficult shape is described.

Properties

COLD FORMING OF PLASTICS. F. H. Müller. Kunststoffe *44*, 569-76 (Dec. 1954). Cold forming or cold drawing at temperatures below the softening point improves the properties of fibers and bristles. A typical phenomenon in cold drawing is necking which separates the stretched part from the not-yet-stretched part. This phenomenon is a flow phenomenon and differs from the slippage phenomenon found in metals. The necking of polyamide fibers is described and a quantitative interpretation is given by analyzing the energy balance of the stress-strain diagram. A possible application of the results of the analysis to cold drawing or forming of other plastics is indicated.

PERMEABILITY OF POLYMER FILMS TO GASES—A SIMPLE RELATIONSHIP. V. Stannet and M. Szwarc. J. Polymer Sci. *16*, 89-91 (Mar. 1955). It was found that the permeability constants for gas-polymer systems follow a simple relationship even though individual constants vary



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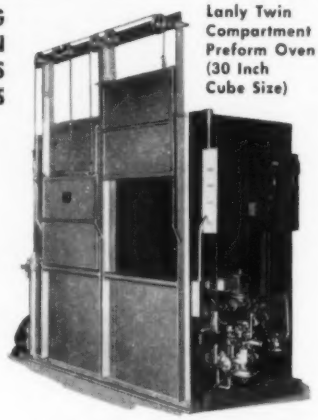

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widely. The permeability constant is the product of three factors: one is determined by the nature of the polymer film, the second by the nature of the gas, while the third accounts for the specific interaction between the gas and the film. Applications are described.

PLASTICIZER MIGRATION. K. Zöhrer and A. Merz. Kunststoffe *45*, 9-12 (Jan. 1955). Tests were made to determine the amount of plasticizer migration from dioctyl phthalate plasticized polyvinyl chloride into other materials. The polyvinyl chloride film was sandwiched between other materials, such as rigid and plasticized polyvinyl chloride, polyethylene, cellulose nitrate coatings of various compositions, leather, etc. The percent weight loss of the polyvinyl chloride was determined at various temperatures. Chemical interaction, surface activity, porosity of the absorbent, and temperature affect the volatile loss of the plasticized polyvinyl chloride. The majority of the experiments were made to investigate the interaction of the plasticized polyvinyl chloride with cellulose nitrate coatings.

Testing

ULTRA-VIOLET SPECTROPHOTOMETRIC DETERMINATION OF POLYMERIZED STYRENE IN STYRENATED FATTY ACIDS AND ALKYD RESINS. R. C. Hirt, R. W. Stafford, F. T. King, and R. G. Schmitt. Analytical Chem. *27*, 226-28 (Feb. 1955). A rapid method for the determination of polymerized styrene in styrenated fatty acids and alkyd resins utilizes an ultra-violet spectrophotometric method. Corrections are made for the overlapping absorption of conjugated triene fatty acids and residual monomeric styrene. The method as tested on a variety of styrenated fatty acids is superior in both speed and accuracy to the chemical method based on saponification value.

Publishers' Addresses

Analytical Chemistry: American Chemical Society, 1115 Sixteenth St., N.W. Washington 6, D.C.
Architectural Forum: Time, Inc., 9 Rockefeller Plaza, New York 20, N.Y.
British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London S.E. 1, England.
Canadian Plastics: Monetary Times Printing Co., Ltd., 341 Church St., Toronto 2, Ontario, Canada.
Industrial and Engineering Chemistry: American Chemical Society, 1115 Sixteenth St., N.W. Washington 6, D.C.
Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N.Y.
Kunststoffe: Carl Hanser Verlag, Leonhard-Eck-Strasse 7, Munich 27, Germany.
Materials and Methods: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

FABRIC. A. R. Morrison (to Owens-Corning). U. S. 2,703,774, Mar. 8. Fabric of glass and synthetic yarns.

BONDING. S. A. Leader and D. A. Leader. U. S. 2,703,776, Mar. 8. Bonding fabrics.

PLASTICIZERS. J. M. Butler (to Monsanto). U. S. 2,703,791, Mar. 8. Vinyl chloride polymers plasticized with polycarboxylates.

RESINS. E. L. Kropa and R. P. Welcher (to American Cyanamid). U. S. 2,703,792, Mar. 8. Reversible oxidizable and reducible phenolic resins.

POLYMERS. M. A. Naylor, Jr. (to Du Pont). U. S. 2,703,793, Mar. 8. Interpolymers of sulfur dioxide with propylene and an acrylate.

POLYMERIZATION. M. J. Roedel (to Du Pont). U. S. 2,703,794, Mar. 8. Ethylene-vinyl acetate polymerization.

CONTAINER. A. Cherkin (to Don Baxter). U. S. 2,704,075, Mar. 15. Flexible plastic container.

DIELECTRIC. P. Robinson and D. B. Peck (to Sprague Electric). U. S. 2,704,105, Mar. 15. Mica dispersed in a polytetrahaloethylene binder.

CELLULOSE ESTER FILM. R. J. H. Alink, J. C. A. A. Jaspers, and T. W. Van Rijssel (to Hartford National Bank). U. S. 2,704,262, Mar. 15. Superficially saponifying a cellulose ester film.

CONDUCTIVE FILM. D. A. Lyon. U. S. 2,704,265, Mar. 15. Electrically conductive films on plastics.

POLYMERS. G. S. Stamatoff (to Du Pont). U. S. 2,704,282, Mar. 15. Polyoxyamides of 3-alkoxyhexamethylenediamines.

MOLDING. A. Cuzzi. U. S. 2,704,380, Mar. 22. Plastics injection molding machine.

PRINTING. W. H. Kreidl. U. S. 2,704,382, Mar. 22. Printing on the surface of polyethylene.

PLASTIC FORMING. A. G. Rose and S. Curtis (to Rose Bros.). U. S. 2,704,520, Mar. 22. Forming indentations in a moving rod of plastic material.

TUBING. M. B. Blish. U. S. 2,704,556, Mar. 22. Flexible plastic tubing.

CASTING. W. D. Hedges and J. C. Lowman (to Columbus Coated Fabrics). U. S. 2,704,735, Mar. 22. Continuous casting of vinyl film.

POLYSTYRENE. E. H. Wood and J. R. Wilkinson (to Carbide and Carbon). U. S. 2,704,749, Mar. 22. Stabilizing polystyrene with resorcinol dibenzoate.

RESINS. L. N. Whitehill and J. A. Arvin (to Sherwin-Williams). U. S. 2,704,750, Mar. 22. Aminoplast resins.

POLYMERS. H. W. Coover and J. B. Dickey (to Eastman Kodak). U. S. 2,704,751, Mar. 22. Polymers of alpha-ureidomethyl acrylonitriles.

POLYMERS. L. J. Monaghan (to Shawinigan). U. S. 2,704,753, Mar. 22. Low molecular weight polymers of vinyl acetate.

EXTRUSION. O. E. Ross and J. L. Williams (to Dow). U. S. 2,705,131, Mar. 29. Mixing head for extruder.

RESINS. M. M. Renfrew and H. Wittcoff (to General Mills). U. S. 2,705,223, Mar. 29. Epoxy-polyamide resins.

POLYMERS. E. J. Kowolik and J. W. Fisher (to British Celanese). U. S. 2,705,225, Mar. 29. Acrylonitrile polymers.

POLYMERS. A. E. Bond (to Imperial Chemical). U. S. 2,705,226, Mar. 29. Vinyl chloride polymers.

POLYAMIDES. G. S. Stamatoff (to Du Pont). U. S. 2,705,227, Mar. 29. Heat stabilization of polyamides.

POLYMERS. H. E. Winberg (to Du Pont). U. S. 2,705,228, Mar. 29. Polymers of unsaturated acid esters of hydroxyalkylcarboxyalkylamines.

CELLULOSE DERIVATIVES. A. L. Allewelt (to American Viscose). U. S. 2,705,231, Mar. 29. Cellulose thiourethanes.

MOLDING. J. W. Hendry (to Tube Plastics). U. S. 2,705,342-3, Apr. 5. Injection molding machine.

PLASTIC FORMING. R. M. Schlabach and L. V. Bockius. U. S. 2,705,346, Apr. 5. Working plastic material.

BAGS. J. L. Colby. U. S. 2,705,443, Apr. 5. Cutting and sealing plastic bags.

HEAT SEAMING. V. H. Hasselquist (to B. F. Goodrich). U. S. 2,705,523, Apr. 5. Heat-seaming thermoplastic sheet.

MOLDING. T. I. Leston (to Eutectic Welding Alloys). U. S. 2,705,669, Apr. 5. Pressure molding thermoplastics.

FLOOR COVERINGS. J. E. Hazeltine, Jr. (to Armstrong Cork). U. S. 2,705,684, Apr. 5. Printed vinyl floor coverings.

SHEET MATERIAL. H. T. Nelson and R. A. Pancheri (to U. S. Rubber). U. S. 2,705,690, Apr. 5. Acrylic sheet.

LAMINATE. A. Panagrossi and R. L. Hauser (to Conn. Hard Rubber). U. S. 2,705,691, Apr. 5. Laminate of fluorine-substituted polyethylene with other substances.

COATINGS. R. W. LaBerge (to Du Pont). U. S. 2,705,702, Apr. 5. Coating of acrylic ester, alkyd resin, and polyester resin.

RESINS. B. E. Sorenson (to Du Pont). U. S. 2,705,704, Apr. 5. Modified phenolic resin.

POLYMERIZATION. A. L. Dittman and J. M. Wrightson (to M. W. Kellogg). U. S. 2,705,706, Apr. 5. Polymerization of perhalocarbons.

RESISTOR. A. M. Daily and G. M. Cocanower (to Chicago Telephone Supply). U. S. 2,705,749, Apr. 5. Variable electrical resistor containing silicone resins.

MOLDING. G. Vennerhelm (to Ford). U. S. 2,705,822, Apr. 12. Sand core molds.

DENTURES. J. E. Watson (to Dentists Supply). U. S. 2,705,836, Apr. 12. Polyester teeth.

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The heating area is 26 by 36 in., and high-temperature radiant-type heaters are used. Heat control is provided by Wheelco Capacitrol, shock-mounted, and coordinated with thermocouple located in heater.

The vacuum system consists of a 14-cu. ft./min. vacuum pump, operated by a ¾-hp. motor to provide 28-in. (mercury) operating vacuum; an automatic 1-in. pilot-operated valve; 133-cu. ft. vacuum reservoir; and vacuum gage. *Auto-Vac Co., 2120 Post Rd., Fairfield, Conn.*

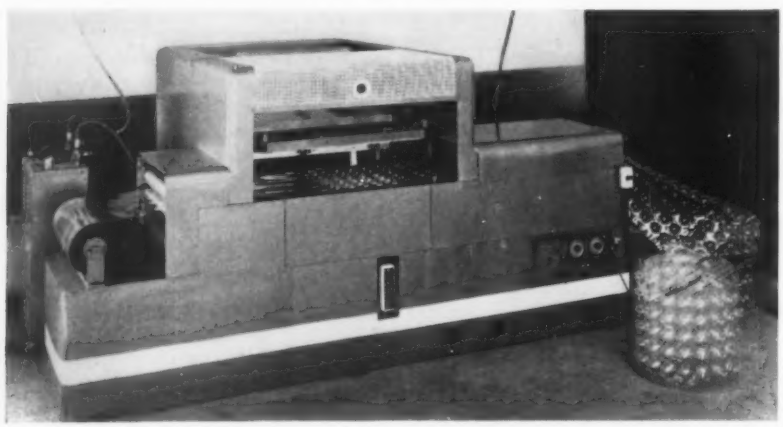
Injection Machines—Line of injection molding machines (Models 3214-12, 3214-16, 3220-12, and 3220-16) is equipped with automatic compensated feed weighing for accurate charge control. Heating cylinder has aligning support so that nozzle may be aligned with sprue bushing. Ram coupling is accessible. Toggle mechanism exerts even pressure between mold faces; all bearings are lubricated by oil under pressure as mechanism operates; movable platen has adjustable stroke for shallow molds. Vertical and horizontal ejector pin holes are provided; six knockout rods are also supplied.

Machines in this line are equipped with Wheelco pyrometers and thermocouples, have low-pressure mold closing for automatic operations, movable platens with 20-in. stroke; temperature control for the nozzle heater element is provided (separate from the automatic controller) through a separate hand-operated unit. A special accumulator and valve arrangement for higher than normal ram speeds is incorporated. Mold space adjustments by hydraulic power are available, and the machines have provision for multiple ram strokes.

Safety gate makes machines operable only when in the closed position. Vickers hydraulic pumps and valves are used. *Lombard Governor Corp., Ashland, Mass.*

Forming Guide—Attachment is said to make possible limited three-dimensional production engraving in two-dimensional engraving machines. The guide consists of an arm and a hardened steel form block and its purpose is to pilot the engraving cutter point over any contoured or irregular surface and control both the shape of the engraved design and the engraving depth. The arm permits engraving of any size cylindrical or spherical parts. Maximum depth of the form block can be ¼ inch. Peripheral engraving in one set-up can be up to ⅛ of the circumference of a cylinder. The block is adaptable to engraving on beveled surfaces with up to 30° angles. It is custom-made to any desired contour to match the part to be engraved, and an assortment of form blocks may be used for a variety of contours in production engraving. *H. P. Preis Engraving Machine Co., 192 Industrial Branch, Hillside, N. J.*

Extrusion Splicer—Precision butt or 90° miter splicer for plastics extrusions is said to complete a splice in 5 seconds. The unit incorporates controls for adjusting temperature of the joint heating knife, and a time delay relay that controls length of dwell of the heating element between the extrusion ends. Capacity



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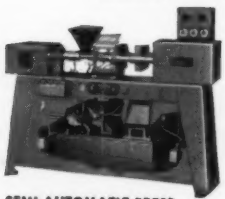

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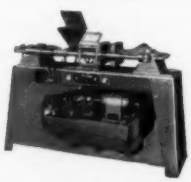
2-oz. capacity.



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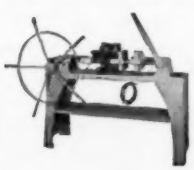
2-oz. and 1-oz. models



MANUALLY OPERATED PRESS
1-oz. For small jobs, training, etc.

PLASTIC GRINDER
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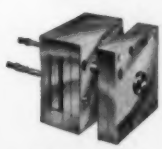


MOLD BASES
Available from stock.

of the model being offered is 1⅞ in. wide extrusions but larger models can be provided, according to the manufacturer.

The machine uses two splice molds. One is a stationary mold equipped with waste gate that cuts flash on impact of the second mold. The latter moves on ways to assure alignment of the extrusion joint. A hinged spacer plate is dropped into position between the molds so that the extrusion ends are accurately spaced. Heat-splice cycle is automatically started when the operator moves the spacer plate from between the molds.

The unit is equipped with a resistance-type heating element that is moved on vertical ways by means of an air cylinder. A heating disk is centered between the extrusion ends with a 1/32-in. gap provided to prevent heating element from contacting extrusion.

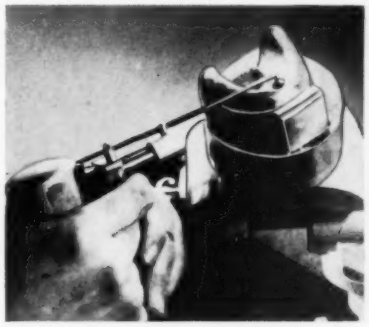
The splicer is mounted on a castered table for incorporation into bench production operations or removal to other locations. Air required for operation of the mold and heater cylinders is 60 p.s.i. *Kel-Min Co., Middlefield, Ohio.*

Production Control—Instrument combines in compact two-case unit a two-pen, two-cam time-program controller with cycle controller that times up to eight operations. The cases can be mounted side by side or one above the other.

The time-program controller can be used to control any combination of two variables such as temperature, pressure, vacuum, etc., through any predetermined program of values by means of a set of two aluminum cams cut to the proper shape. Each of the two cams is individually cut, and locked together in any desired time relationship on a single hub. Thus, temperature, for example, can be controlled through one cycle while pressure is going independently through another cycle, synchronized with the temperature. The two cams can be chained as a unit. The program controllers are available in on-off or proportional electric control; or in pneumatic control in proportional, reset, or derivative methods.

Operations such as opening and closing of valves, switches, and dampers; starting and stopping of motors, pumps, and blowers; and similar operations can be automatically timed by the cycle controller. *The Bristol Co., Waterbury 20, Conn.*

Finishing Attachment—Flexible rod with ball joint diamond file on the end is mounted to provide reciprocating action adjustable from 0 to ¼ inch. The accessory is 6⅞ in. long by ⅛-in. diameter round, with a ⅜-in. diameter ball swivel on which abrasive faces or contoured shapes may be mounted. Total amount of ball action is ⅛ in. at the face.



Nord's Di-Profiler attachment is used for honing and finishing mold cavities, precision-formed pieces, and the like

The attachment finds use for honing and finishing cavities of molds and dies as well as forms and precision-contoured pieces that cannot be easily reached by normal file or finger action.

This extension rod has been designed for attachment to the Di-Profiler, a die filing machine. *Nord International Corp., 449-105 Central Ave., Orange, N. J.*

Gel Time Meter—This instrument measures automatically the time required for a fluid thermosetting composition to reach a point of rapid viscosity change during polymerization. It is an aid in the evaluation of thermosetting compositions used in the manufacture of monomers, resins, varnishes and other protective coatings, or for the study of such variables as reaction temperature, catalyst, inhibitor, quality, and shelf life. The device measures viscosity drag in a test sample by means of a rotating spindle suspended from a torsional spring. At the gel point, viscosity increases suddenly, and the increased drag on the spring closes

a switch which sounds a buzzer, stops a timing mechanism, and gives a visible indication. A means of controlling the temperature of the bath surrounding the sample is provided. *Sunshine Scientific Instrument, 1810 Grant Ave., Philadelphia 15, Pa.*

End Seal—For 4¼- and 6-in. diameter expanders used in the manufacture of textiles, plastics sheets, and paper, an end seal designed to waterproof the bearing area is a precision-molded one-piece accessory that provides a close but non-contacting fit around the expander axle. Grease, injected through a cadmium-plated Alemite fitting, serves as the sealant. Only one fitting is used on each end and is located on the stationary axle so that the expander may be lubricated while in use. A water flinger that throws off most moisture before it reaches the bearing area is included as part of the seal design.

The end seal is available as standard equipment on 4¼- and 6-in. expanders and is also furnished as replacement equipment for earlier model expanders in the same price range. *Mount Hope Machinery Co., 15 Fifth St., Taunton, Mass.*

Steam Trap—Having only one moving part, Type TD "thermodynamic" steam trap for pressures to 600 p.s.i. and temperatures to 950° F., uses the same head and seat for all loads within the trap's capacity range, and close tight on no load. The only operating part is a solid stainless steel valve head. The trap operates as follows (see accompanying illustration): Disk *A* forms a valve which seats on the inlet tube *B* and also on the outer rim *C*. It is free to rise and fall in chamber *F*. When heated, disk *A* closes steam inlet tube *B*, and also seals chamber *F* from the discharge. Pressure in inlet tube *B* raises the disk, allowing air and/or condensate to flow radially across the underside of disk *A* to outlet tube *E*. When steam follows, the high-speed radial jet through tube *B*, creates a low-pressure area under the disk and, on striking the wall at *H*, is deflected into the control chamber *F* where it immediately builds up pressure by recompression. The pressure in the control chamber, acting on the full area of the disk, exceeds the combined force of the incoming steam and the low-pressure area, and the disk snaps closed. As the pressure in chamber *F* decreases by condensation, pressure in inlet tube *B* again raises disk *A* and the cycle is repeated.

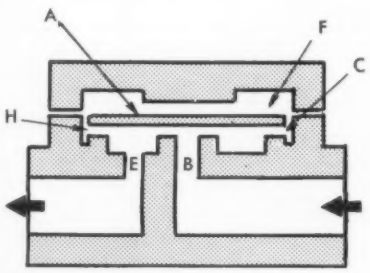


Diagram indicating the operation of Sarco's "thermodynamic" steam trap

The valve is said not to be affected by super heat, corrosive condensate, water-hammer vibration, pressure, or load changes. *Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.*

Compression Press—Model 1400-50 automatic press for phenolics, ureas, alkyds, Teflon, melamines, and other thermosetting materials can be operated manually, semi-automatically, or automatically. Press has a closing speed ranging from 10 to 366 in./min., with automatic deceleration possible at any point of the stroke. The machine is available with both automatic powder feed or rope feed attachments.

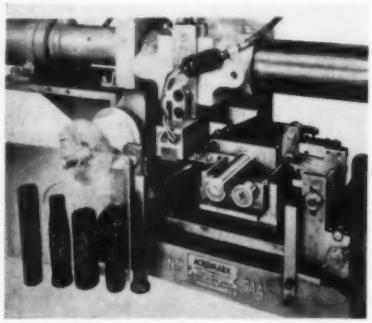
Motor, pump, and valves are said to be easily accessible. Hydraulic reservoir, with thermostatically controlled water cooling system is separate. The hydraulic system is powered by an Oil-Gear duplex, axial piston-type pump. All valving is gasket-mounted and a specially designed valve manifold is reported to eliminate all flexible lines.

Electrical controls are included as original equipment. Said to be incorporated for the first time in presses of this type, Potter and Brumfield "throw-away-type" relays permit changes without downtime. Wheelco mold temperature control instruments are optionally available.

Stroke of press is 10 in. and daylight with fixed head is 25 inches. Over-all height is 96 in., weight is 5000 pounds. Top-mounted 40-sq. in. single-casting hydraulic cylinder has working pressure of 2650 p.s.i. to de-

liver pressures controllable from 6 to 50 tons. Eight-cavity automatic feeder, four-cavity automatic feeder, rope feeder, and loading board for multiple cavities are available. *Baker Brothers, Inc., P. O. Box 101, Station F., Toledo 10, Ohio.*

Mandrel-Cradle Fixture—Combination-type device for holding plastics, metal, and wood parts for mechanical marking incorporate a drive-rotary mandrel and a set of roller bearing cradle rolls to accomplish controlled rotation of parts to



Acromark's mandrel and cradle fixture acts to control rotation of parts requiring heavy marking pressures

be marked in cases where substantial marking pressure is necessary. This attachment is said to permit either hot or cold marking, with or without electrically heated color transfer. *The Acromark Co., 561 Morrell St., Elizabeth 4, N. J.*

Control Equipment—Production analyzer Model 5-D for sheet materials divides total production into five weight or thickness classifications to provide quality control checks. Amount of machine downtime is also indicated.

Total figures, in units of feet or yards, or multiples thereof, are presented by four sets of numerical counter panels set in the face of the instrument. In the top panel section, figures indicate the amount of production falling in the "premium" classification; below the premium classification, a second panel with two counters shows total production of "good" materials, one counter showing amount of material under and the other amount of material over "premium" but within production tolerance limits; a third panel, also consisting of two counters,

shows amount of reject material, broken down into material above and below "good." Down-time is indicated on a fourth panel.

Classifications are adjustable for desired quality spreads.

The unit operates over a wide range of process speeds and is directly tied in with production cycles. *Industrial Nucleonics Corp., 1265 Chesapeake Ave., Columbus 12, Ohio.*

Speed Meter—Designed for measuring straight-line speed of moving sections of fixed machinery, portable Celerimeter has a range of from 5 to 30,000 in./minute.

An example of its use is the determination of the proper plunger speed on an injection machine. After adjustments are once made to produce the best part, the plunger can thereafter be regulated through use of the Celerimeter without spoilage. Other measurements possible are pressure build-up time, compression period, complete cycle time, conveyor speeds, etc.

The Celerimeter operates on 110-v. 60-cycle lines, comes in a case measuring 9 by 9 by 21 inches. *Lake Erie Engineering Corp., Box 68, Kenmore Station, Buffalo 17, N. Y.*

Motor Valve—An all-metal bellows-type motor valve has been developed for use as a final control element in pneumatic and hydraulic systems to maintain pressure, temperature, or level in industrial vats, tanks, and processes. According to a survey conducted by the manufacturer, the new control, designated No. 992-D bellows motor valve, is satisfactory for over 50% of industrial applications where motor valves are used. The valves have a linear movement and are available in sizes from ¼ to 4 in. and in a variety of types. They are supplied in direct- or reverse-acting models. *Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville, Tenn.*

Slitter-Rewinder—This 40-in. slitter-rewinder for use with plastics has variable speed drive with electric clutch and is available with shear cutter and an automatic web guide. It can be synchronized with companion machinery to provide a smooth-flowing over-all operation. A static eliminator and blower-vac-

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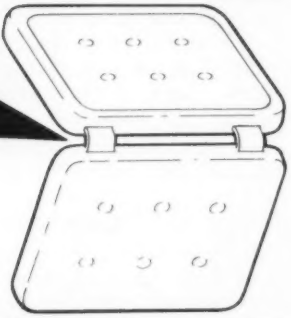

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GRINDING REINFORCED PLASTICS. Illustrated literature provides case history data on use of various abrasives in sanding, grinding, and polishing fibrous glass reinforced plastics parts. The Carborundum Company. **(G-501)**

HIGH-IMPACT RESIN. Detailed technical report on "Cycolac," a styrene base thermoplastic, enumerates its physical and chemical properties and offers explicit recommendations for its compounding, pigmenting, extruding, molding, calendering, sheet forming, and decorating. Marbon Chemical, Division of Borg-Warner. **(G-504)**

MACHINING LAMINATES. Illustrated manual describes techniques and machinery for sawing, turning, boring, threading, drilling, milling, punching, and gear cutting of high pressure laminates. Synthane Corporation. **(G-509)**

CEMENTING OF PLASTICS. Manual gives detailed "how to" information on cementing techniques, use of fixtures and clamping devices, types of cement and methods of cement application in assembling and fabricating operations. Plastics Div., Monsanto Chemical Co. **(G-519)**

PLASTICS FOR ELECTRONICS. Loose-Leaf catalog contains technical data on company's line of casting resins, impregnating resins, laminating resins, potting compounds, plastic cements, synthetic foams, and rod and sheet stock having special utility in the electronics field. Emerson & Cuming, Inc. **(G-524)**

COATED ABRASIVES FOR PLASTICS. Illustrated manual describes methods for using coated abrasives in the plastics industry. Also includes a reference chart of sanding practices to be followed in finishing, applicable to the 69 plastic materials listed. Behr-Manning, Division of Norton Company. **(G-532)**

Any of the booklets described here, plus many others—forty-four in all—are available for the asking, without charge or obligation.

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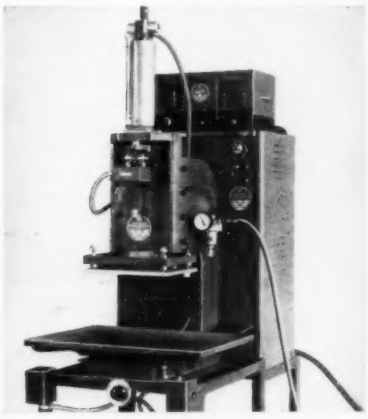
575 Madison Ave., New York 22, N.Y.

uum system (for instant removal of trim) are incorporated. *Hobbs Mfg. Co., 311 Salisbury St., Worcester, Mass.*

Heat Sealer—Equipped with a high-speed, high-sensitivity spark eliminator to prevent die damage, this heat sealing machine has a generator rated at 3 kilowatts. Size of bed is 19 by 25 in., daylight is 8½ in., and the ram is 6 in. wide. The equipment is claimed to handle all gages of plastic film.

The sealing machine can be equipped with a Cosmo-Crome unit, an accessory that makes it possible,



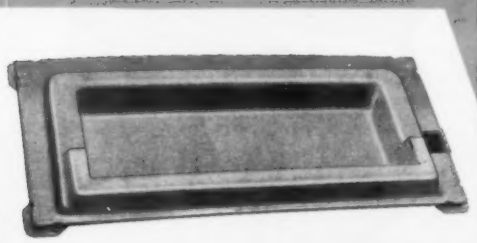
Cosmos Electronic's heat sealer has 3-kw. generator, 19- by 25-in. bed, and a daylight opening of 8½ inches

in conjunction with Cosmo-Crome dies, to make edges in a different color without an extra sealing operation. Three-dimensional appliqués in different colors are also said to be possible. *Cosmos Electronic Machine Corp., 656 Broadway, New York 12, N. Y.*

Plastics Dicers—New line of machines for dicing plastics sheets up to ⅛ in. thick at lineal speeds of up to 85 ft./min. comprises three sizes: 6-, 10-, and 14-in. feed. Incorporation of a new type of notched-knife system, with feed rolls located close to the cutting element, is claimed to provide better control of material and produce more uniform pellets.

With these machines, it is claimed that rigid and semi-rigid plastics can be diced into perfect cubes; noncubic pellets can be produced by changing the knives. Length of pel-

(*To page* 157)



For the cavity for this refrigerator door panel mold . . .

J. B. Rath Co.
Van Dyke, Mich.

reports this about . . .

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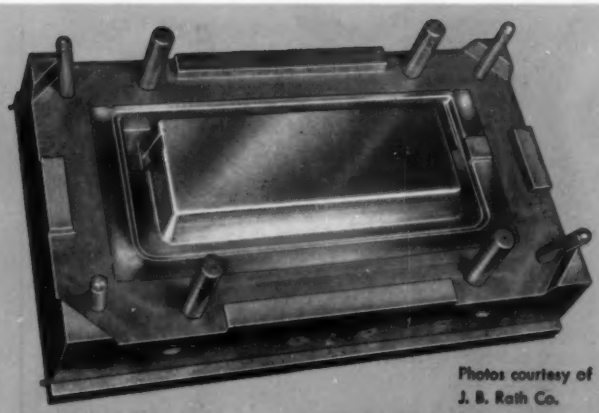
prehardened MOLD STEEL

1. **Machinability equal to other popular prehardened steels.**
2. **Polishability was excellent.**
3. **Excellent weldability of Cascade was noted on engineering changes.**



Photos courtesy of J. B. Rath Co.

In the above application, the portion of the mold built of Cascade is the critical cavity. Cascade's uniform hardness throughout the entire 6″ x 20″ x 36″ section assures strength in all critical areas.

Cascade's excellent finishability and weldability (a result of Cascade's precipitation hardening metallurgy) have been noted by many leading molders and moldmakers. These properties, together with others, make Cascade a preferred choice among prehardened steels for plastic injection molds where highest quality is demanded.

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lets is determined by lineal speed of flow. For chopping extruded rods of plastic, straight knives are used. *Mitts & Merrill, Inc., Saginaw, Mich.*

Multiple-Platen Press—New ten-opening hydraulic platen press of 1100-ton capacity and with a platen size of 42 by 42 by 2½ in., is elevator-fed and can be used with an accumulator system or a self-contained pumping unit. Its over-all dimensions are as follows: 14 ft. high, 5 ft. wide, and 4 ft. deep. *R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.*

Stiffness Tester—The Carson-Worthington Universal Stiffness Tester, applicable to dissimilar materials and varying thicknesses, has been developed to measure stiffness and related properties of paper, cards, plastics sheets and films, coated fabrics, metal foils, etc. Interchangeable torsion units are adjustable to different sample sizes and a wide range of stiffness values. Data are recorded in gram-centimeters (rather than in relative units), making possible comparisons between test methods or between materials. *United States Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.*

Tablet Presses—Two single rotary tablet presses, said to be capable of producing 36,000 p.s.i. maximum pressure for production of all kinds of tablets from powders and granulations and for preforming plastic materials, are reported to have double the tonnage capacity of former models. The presses incorporate fully enclosed 3-hp. ball bearing, fan-cooled, variable-speed motor drives which provide a broad range of operating speeds for these tabletting units.

Model 240RP is a 16-station rotary tablet press on which tabletting or heavy slugging operations can be performed at pressures up to 36,000 p.s.i. at rates up to 700 per minute. It is capable of handling tablets up to 1-in. diameter and has a $^{13}/_{16}$-in. fill depth.

Model 250RP is a 12-station press which operates at rates up to 600 tablets per minute. Maximum tablet diameter is 1¼ in. and fill depth is 1⅛ inch. *Arthur Colton Co., Div. Snyder Tool and Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.*

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Plastics Tooling," by Malcolm W. Riley

Published in 1955 by Rheinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 123 pages. Price: $2.50.

The latest in the Pilot Books series, this one deals with the relatively young field of plastics tooling. In the form of an interim report on the status of this production method, the text covers the pro's and con's of plastics tools, plastics tooling resins, and the fabrication of tools (checking, locating, and assembly fixtures; metal forming tools, plastics forming tools, die models and prototypes, and experimental tools). A bibliography is included.

"ASTM Standards on Electrical Insulating Materials"

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 660 pages. Price: $5.50.

This compilation covers 60 methods of test, 17 specifications, 3 recommended practices, and a list of definitions. The compilation includes revisions accepted through February 3, 1955. Four appendices discuss the significance of tests of electrical insulating materials; recommendations for writing statements as to usefulness of tests of electrical insulating materials; and two proposed methods of test—one for dielectric constant and dissipation factor of aviation fuels, and one for pasted mica used in electrical insulation.

"Plastics in Building"

Published in 1955 by Building Research Institute, National Academy of Sciences, National Research Council, 2101 Constitution Ave., Washington 5, D. C. 150 pages. Price: $5.00.

In October 1954, the Building Research Institute of Washington, D. C. organized a conference to acquaint builders, architects, and contractors with the potentials of plastics in the construction industry. Speakers at the meeting were authorities in the plastics industry who were expert in those of its phases which were of interest to the building industry. The papers presented at the conference, and some of the discussion following their presentation, have been compiled in the present volume.

Broadly classified, the topics covered were: 1) an introduction to plastics in building (properties, evaluation); 2) specific uses of plastics in building (glazing, structural panels, insulation, surfacing, piping, etc.); 3) future uses of plastics in building; and 4) summaries of the conference.

These papers present a realistic appraisal of the role of plastics in building construction. Pregnant with many application suggestions, they should be of extreme interest to anyone connected with building field.

"Design in British Industry," by Michael Farr

Published in 1955 by Cambridge University Press, 32 E. 57th St., New York 22, N. Y. 333 pages. Price: $11.00.

"A mid-century survey" is the sub-title of this handsome volume; it takes a close look—from the design point of view—at the things our English cousins use in their daily living, e.g., furniture, carpets, linoleum, light metalwork, jewelry, radio cabinets, textiles, wallpapers, pottery, cars, and the like. In addition, the author investigates British industry with an eye on size and organization of factories, production methods, creators of design and public taste, market research, and similar phases. A section on design organizations is also included.

No mid-century survey of design could, of course, be complete without attention to the role of plastics; and the book describes numerous applications of various plastics materials.

"Tariffs: The Case for Protection," by Lewis E. Lloyd

Published in 1955 by The Devin-Adair Co., 23 E. 26th St., New York 10, N. Y. 207 pages. Price: $3.50.

The question of tariffs is of prime concern to the chemical and plastics industry. Here the author has undertaken to survey the problem from its origin (1791) to its present-day ramifications. He indicates the far-reaching effects of tariffs on industrial research, industrial development, wage levels, and other economic and defense aspects. As he candidly states in the title of this survey, he is strongly in favor of tariff protection—and adduces many a cogent argument to support his view.

"Bestimmung des Molekulargewichts von Polyamiden," by W. N. Dawydoff

Published in 1954 by Veb Verlag Technik, Under den Linden 12, Berlin, N. W. 7, Germany. 98 pages. Price: DM 9.-(ca. $2.25)

This little book presents a survey of research results in the field of molecular weight determination of polyamides. While work done on that problem in the United States and in Russia is not included, European and some other overseas achievements are fully treated. Discussed are the following topics: Determination of molecular weight of high polymers by 1) measurement of osmotic pressure; 2) the sedimentation methods; 3) diffusion; 4) measurement of the Tyndall effect; and 5) measurement of relative viscosities of polymer solutions. An entire section is devoted to an investigation of the viscosimetric technique of molecular weight determination (including a chapter on Staudinger's law). A discussion of methods used in the determination of molecular weight of polyamides before and after 1946 is included, with special reference to polycapromides.

Laminates—Catalog D-55 lists a line of laminated plastics in sheet, rod, and tube form, in a range of colors and grades. Included are phenolic-glass, polyester-glass, phenolic-fabric, phenolic-paper, and phenolic asbestos laminations. Special sections deal with metal clads, post-forming of laminates, rolled and molded tubes, molded and turned rods, and Teflon. Properties and specifications for each grade are given. *Continental-Diamond Fibre Co., Newark, Del.*

Industrial rolls—Report No. 6, "Roll Surface Finishes," discusses the subject in relation to the design and selection of rolls for specific plant applications. The report covers the various types of instruments used to

measure surface roughness, such as profilometers and visual scales. It also treats with lathe finishing, deburring, polishing, grinding, and ways to correct rough surface finishes. A chart to assist in selection of proper roll surface finishes is included. *Rodney Machine Co., Orange, Mass.*

Freight classification—Plastic Classification Guide No. 4 covers the following: description, for transportation purposes, of various plastics items; class ratings as covered by the four major classifications issued to cover movement between all points in the United States; territorial description of all classification areas; and map of territory which is governed by the classification published by the New England Motor Rate Bureau, Inc. *The Society of the Plastics Industry, Inc., Traffic Committee, 67 W. 44th St., New York 36, N. Y.*

Automation—Educational Bulletin No. 9 discusses the application of automatic control equipment to the solution of industrial process control problems. The brochure covers conventional millivoltmeter construction and its application to a control instrument as well as the function of an oscillator circuit in a pyrometer controller, along with various control forms which can be developed from this type circuit. Of particular interest to control engineers is a description of saturable core reactor control for electric loads. *Barber-Colman Co., Wheelco Instuments Div., Rockford, Ill.*

Vacuum pumps — This eight-page bulletin presents design, construction, and specification information on a line of vacuum pumps and compressors which find application in various phases of plastics processing. *Lammert & Mann Co., Inc., 1753 Walnut St., Chicago 12, Ill.*

Plastics products — Two catalogs cover a line of plastic office supplies, school equipment, and housewares. *Northeastern Plastics, Inc., 215 A Street, Boston, Mass.*

Industrial tapes—Three controlled-strength waterproof tapes for industrial applications are described in this four-page brochure. Typical uses for these tapes are protecting insulating materials in refrigerators and freezers, guarding metal parts of lift trucks against condensation during overseas shipment, and sealing of cartons to prevent moisture damage to contents. Thickness, tensile strength, tear resistance, adhesion, chemical resistance, and electrolytic corrosion properties are given for each tape. *Polyken Products, Dept. of The Kendall Co., 222 W. Adams St., Chicago 6, Ill.*

Rigid plastics pipe—This bulletin outlines the use of polyvinyl chloride in the fabrication of exhaust systems, process equipment, and processing tanks. Data on properties are included. Also presented is a section on plastic pipe and fittings. *The Atlas Mineral Products Co., Mertztown, Pa.*

Vulcanized fibre — Folder DVF-55 gives property information and specification data on a line of vulcanized fibre, available in sheet, rod, strip, block, tube, and roll form. Engineering data are included. Also presented is a section on fibre fabrication. *Continental-Diamond Fibre Co., Newark, Del.*

Itaconic acid—Index-type technical bulletin No. 82 outlines the uses and properties of itaconic acid, a versatile organic compound made in commercial volume by fermentation. Molecular structure, reactions, polymerization, patents, and packaging and shipping data are included. The material is suggested as an intermediate in the preparation of pharmaceuticals, dyestuffs, and other complex organic compounds. Derivatives of the compound may be used in the preparation of plasticizers, polyester resins, and as co-monomers in the production of polymeric materials. *Chas. Pfizer & Co., Inc., Chemical Sales Div., 630 Flushing Ave., Brooklyn 6, N. Y.*

Plastic containers — A catalog of plastic containers, reported to be the only such catalog available to the packaging industry, presents a complete selection of nearly 200 different containers made of Styron for the packaging of cosmetics, pharmaceuticals, fresh vegetables and produce, dairy products, ice cream, candy, and delicatessen foods. Each container is photographed to show its detail, and the size, type of lid or cover, hinge description, and color of the container are listed. Also provided is the name of the sales manager of each company producing the various containers and its complete address. *The Dow Chemical Co., Midland, Mich.*

Polystyrene — This six-page folder gives detailed information on Kleestron "H," a high-impact polystyrene. Data on molding, extruding, finishing, color matching, and applications are included. Technical and property information is also provided. *Kleestron Ltd., West Halkin House, W. Halkin St., London S.W. 1, England.*

Materials handling — Bulletin No. 1206, printed on letter-size file folder, lists a complete materials handling equipment line. Products are arranged in alphabetical order. *Materials Handling Div., Market Forge Co., Everett, Mass.*

Adhesives for film—"How to Handle Adhesives for Transparent Films" covers emulsion adhesives and lacquer adhesives, when and how to use them, and various production problems related to their use. The booklet incorporates a chart describing the properties and characteristics of all principal types of transparent film including Mylar, cellophane, Pliofilm, polyethylene, and cellulose acetate. *National Adhesives, Div. National Starch Products, Inc., 270 Madison Ave., New York 16, N. Y.*

Fused silica—Specifications for a line of Rotosil fused silica rods, tubing, crucibles, and vessels are presented in this four-page folder. Physical and electrical properties, as well as applications, are given. *Amersil Co., Inc., 685 Ramsey Ave., Hillside 5, N. J.*

Controllers—Bulletin, 5A-13, describes new Model 41A pneumatic indicating controller, replacing the earlier Model 41 for control of process variables such as temperature, pressure, liquid level, and humidity. Instrument provides proportioning action adjustable from ¼ of 1% to 25% of scale range. Proportioning mechanism is diagrammed and explained; typical applications are shown. Separate sections deal with temperature and pressure measuring systems, filled thermal systems,

temperature bulbs and accessories, pressure elements, pressure seals, and control valves. Specifications are given. *The Foxboro Co., Foxboro, Mass.*

Brakes—Eight-page folder illustrates and contains specifications on new steel press brakes and forged steel press brake dies. Standard brake dies up to 12 ft. may be ordered from folder. *Service Machine Co., Inc., 660 Miller St., Elizabeth, N. J.*

Spray Masks—A line of paint spray masks is described in this 20-page booklet. Included are cap masks, plug masks, area masks, wiping masks, rolling masks, drop masks, multi-cavity masks, baffled masks, book masks, and mask fixtures. Applications are given for each model. *Wm. M. Fiore, Inc., 135 Liberty St., New York 6, N. Y.*

Catalysts—Technical Bulletin 20 details the uses, advantages, and requirements of activated carbon as a catalyst or catalyst support in a variety of chemical processes. Particle sizes, chemical and physical properties, and specifications of numerous types of extra-hard granular and powdered Adsorbite activated carbons and activated carbons impregnated with metallic salts (for catalyst support) are covered. *Adsorbite Div., Barnebey-Cheney Co., Cassady at E. 8th Ave., Columbus 19, Ohio.*

Catalog—Price list for SR-4 strain gages, instruments, accessories, cements, and waterproofing equipment, with revised quantity discounts, includes specifications for all sizes and types of bonded resistance wire strain gages, and tells how to select the right gage to meet various conditions of use. *Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.*

Epoxy adhesive—Descriptive literature, specifications, and price information on a line of epoxy resin adhesives for bonding thermosetting plastics either to themselves or to other rigid materials is contained in this 16-page brochure. A formulation for use with aluminum and copper is also presented. In addition, the brochure contains information on clear epoxy resin formulations which are supplied without filler content and are used as adhesives on applications where contrasting glue lines are undesirable, as well as in potting, casting, and laminating. *Armstrong Products Co., P. O. Box 1, Warsaw, Ind.*

Vacuum forming—Bulletin 55 describes and illustrates some of the construction and operation details of a new line of vacuum forming equipment. (See MODERN PLASTICS *32*, 170, June 1955.) *Auto-Vac Co., 2120 Post Rd., Fairfield, Conn.*

Plastics for layman—Sixth revised edition of "Plastics, the Story of an Industry," presents a brief over-all picture of the entire plastics industry, touching on its history, development, branches, manufacturing processes, types of plastics, and products made from them. There is reference to employment opportunities, educational facilities, plastics trade publications, and a bibliography. Prices are as follows: 10 to 50 copies—30¢ each; 51 to 500 copies—28¢ each; 501

to 1000 copies— 26¢ each; and over 1000 copies—25¢ each. *The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.*

Movies about plastics—Catalog lists motion pictures on various phases of the plastics industry which are available for public showing. They cover varied subjects from plastics raw materials, through manufacturing processes, to the finished product. A brief description of each, the terms, conditions, and the company or agency from which the film may be obtained are included. Information on running time, color, and sound is also included. An alphabetical and a classified index are listed. *The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.*

Consultants—The 15th edition of "Consulting Services (1955)" runs 144 pages and is divided into three sections as follows: Classified—Lists over 200 fields of activity, cross-referenced as to qualification and specialization of various consultants; Scope Pages—Describes each consultant's qualifications and activities; Index—Broken into alphabetical order by members (including organizations with which they are affiliated) and geographical order (including branch offices, domestic as well as foreign). $1. *Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y.*

Materials handling — Condensed catalog No. 554 contains technical data, brief description, and photographs of vibratory equipment, feeders, conveyors, power tools, shaft seals, diesel pile hammers, gasoline hammers, selenium rectifiers, and other materials handling equipment. *Syntron Co., 390 Lexington Ave., Homer City, Pa.*

Glycol-ether — Four-page technical bulletin F-4811A on Carbitol acetate discusses uses of this chemical as well as its physical and chemical properties, specifications, shipping data, and general solvent properties. Carbitol acetate is one of the few commercially available, high-boiling, entirely water-soluble esters. Its high boiling point and slow evaporation rate make it particularly useful in surface coatings where a strong, slow-evaporating solvent is of pri-

mary importance. It is a good cellulose nitrate solvent and is used in lacquers that are stencil-printed on textiles. When used in printing inks it helps prevent gumming on print rolls and still permits rapid operation. *Carbide and Carbon Chemicals Co., 30 E. 42 St., New York 17, N. Y.*

Vulcanized fibre—This four-page reprint presents detailed specifications covering the physical and chemical properties of the many grades of vulcanized fibre (including commercial fibre, bone fibre, Peerless electrical insulation, and trunk fibre) and covers fabrication methods such as drilling, blanking, forming, piercing, and lathe turning. Applications illustrated include armature insulation, fibre gearing, abrasive disk backing, automotive and athletic parts, textile shuttles, fuse housings, rail joint insulation, and self-locking nut collars. *National Vulcanized Fibre Co., 1055 Beech St., Wilmington 99, Del.*

Ceiling material — Properties and uses for Boltaron LC 9100, a low-cost corrugated luminous ceiling material, are described in this booklet. Prices are included. *Bolta Products, Div. of The General Tire & Rubber Co., Lawrence, Mass.*

Compressed air—Bulletin 520-A presents hook-up sketches to help users of compressed air to improve the capacity of their installations. Brochure also describes cooling controls for compressor jackets, aftercoolers and intercoolers, drain traps, electric thermostats, and pressure switches. *Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.*

Mask washing—Illustrations and descriptions of the operation of a line of automatic mask washing machines are given in this bulletin. Advantages claimed for this system are outlined. *Conforming Matrix Corp., 364 Factories Bldg., Toledo 2, Ohio.*

Temperature control systems—Of interest in the application of automatic control to industrial process applications, Bulletin F-6149-2 describes sensing elements and their correct uses. Control terminology, as well as rules to use as a guide for the selection of a proper method of control for process characteristics are included. Also contained in the bulle-

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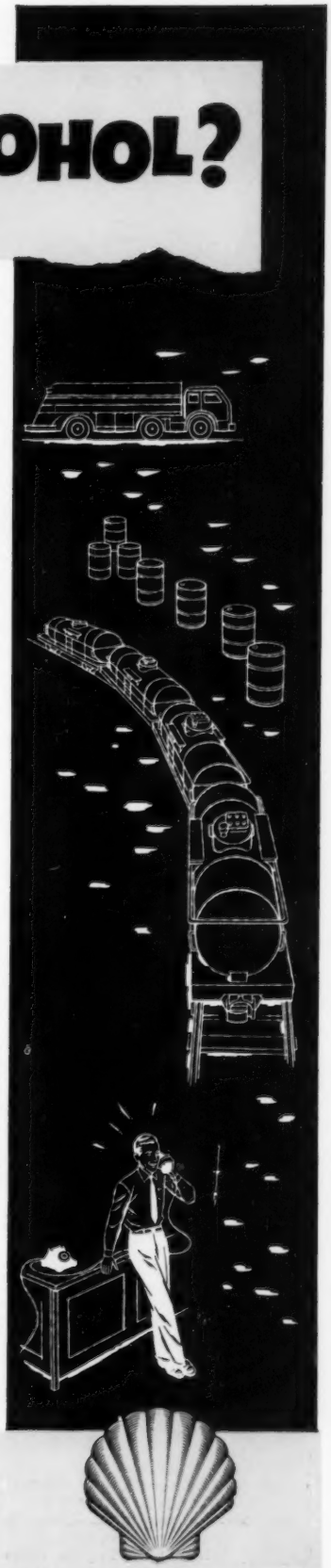

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tin is an explanation of the various types of control systems, ranging from two-position "on-off" to proportional position with automatic reset. *Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.*

Luminous ceilings—New ways to increase lighting efficiency, economy, and design flexibility are suggested in Brochure J-852. Photographs of installations in school, office, home, factory, restaurant, and library are included. The uniform light transmission and good aging characteristics of a line of rigid vinyl sheeting are described, along with their adaptability to fresh designs. The advantages offered by this material in terms of safety, simplicity of installation, ease of maintenance, and lower cost are also discussed. *Bakelite Co., 300 Madison Ave., New York 17, N. Y.*

Tramp metal—Data sheet 3R2602 describes equipment designed to prevent tramp metal damage to calender rolls, cutting knives, and molds. Specifications and installation instructions are given. *Inspection and Control Equipment, Radio Corp. of America, Camden 2, N. J.*

Puerto Rican opportunities—"Facts for Businessmen" is a 72-page brochure outlining industrial opportunities in Puerto Rico. The booklet describes the experience of 300 mainland manufacturers who have expanded to the island since 1947 and discusses such incentives as freedom from federal taxation, local tax exemption, wage rates, public utilities, financial facilities, etc. *Economic Development Administration, 579 Fifth Ave., New York 17, N. Y.*

Foams—Two reports of government-sponsored research in the development and testing of low-density plastic foams for both general application and use in aircraft, cover a low-density silicone resin core material having the desirable physical properties of previously prepared foams but having also a thermal stability which permit its continuous use at 300 to 500° F. and intermittently at higher temperatures, as well as work done on measurement of dielectric constants and loss tangents of 79 materials potentially useful in radome construction. The first report is entitled "Development of a

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With an Abbott Plastic Die Press you are assured of greater savings, — low initial cost, — low die costs, — and low production costs.

All these features can only be possible thru Abbott's efficient design, good materials and excellent workmanship.

FEATURING

- 14 inch daylite opening, (a plastic part drawn 14" deep can be cut without moving die).
- Stroke is adjustable from 1" to 14" platen opening.
- Platens are 36" x 36" or 9 sq. ft. cutting area.
- Press designed to cut 500 lin. in. of .100 thickness material at rated 60 tons pressure. (Thinner material in direct proportion.)
- Lower platen is adjustable at 3" intervals.
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- Controls are all air operated with complete safety features to protect operator.
- Designed for use of simple steel rule dies.
- Pneumatic cylinder operates compound toggles for simple trouble free fast operation.
- Simplified construction, accurate machining in a steel frame.

14" STROKE (COMPOUND TOGGLES)
60 TON PRESSURE - 36" x 36"
PLATEN AREA - FULL SAFETY FEATURES

MODEL A.P.M. P36
PRICE $4,700.00
(F.O.B. Our Plant, Chicago, Ill.)

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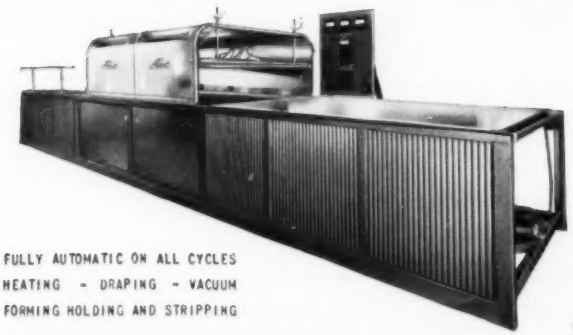

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GENERAL SPECIFICATIONS FOR ABBOTT PLASTIC DIE PRESS

MODEL	FLOOR AREA	CYLINDER	MAX PLATEN STROKE	AIR PRESS P.S.I	APPROX SHIPPING WEIGHT
APM P36	4-0 x 4-0	8 DIA	16"	100 TO 150	7,000 LBS

The 4 Abbott Models

All TWO-STATION Units

MODEL NO	SIZE	PRICE
APM 30	30" x 30"	$2,480.00
APM 40	40" x 40"	3,680.00
APM 60	60" x 60"	7,400.00
APM 90	60" x 90"	9,480.00

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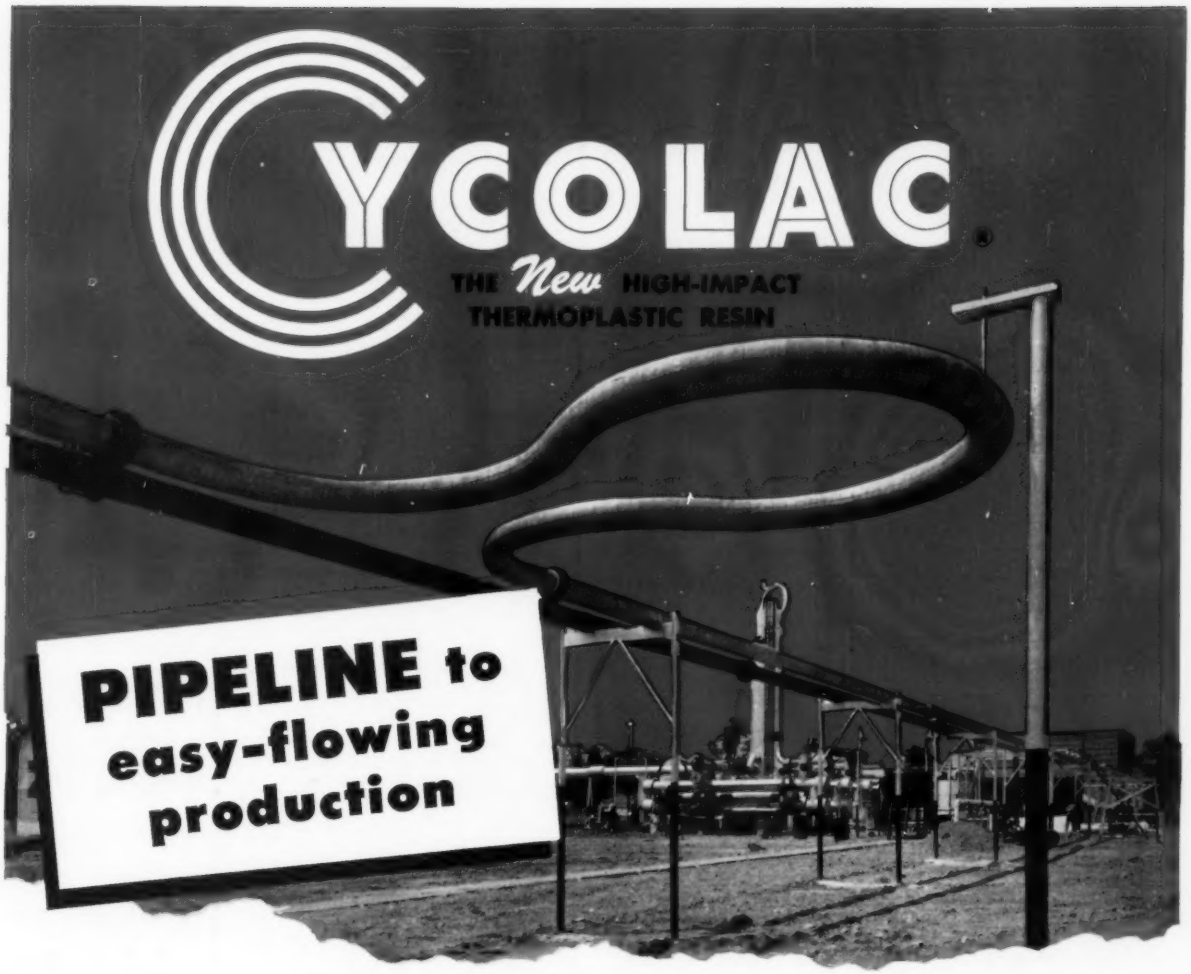
Buying custom moldings—"How to Buy Custom Molded Plastics" is designed to acquaint purchasing agents having occasion to buy plastics parts with some of the do's and don'ts of efficiently buying custom molded plastics. (A similar booklet was published by the Canadian SPI and has previously been reviewed in these columns, see MODERN PLASTICS *32*, 190, November 1954.) Minimum order 10 copies; under 100 copies 20¢ each, 100 to 200 copies 16¢ each, 201 to 500 copies 14¢ each, over 500 copies 12¢ each. *The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.*

Butyl Carbitol—Four-page technical information sheet on butyl Carbitol lists physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, physiological properties, and uses. Butyl Carbitol is a good solvent for cellulose nitrate and many other resins. It is especially useful in lacquers, dopes, stamp pad inks, and printing inks where a solvent with an extremely low rate of evaporation is required. It is valuable in specialty soaps, soluble oils, and textile oils; it is also a dispersant for vinyl chloride resins used in organosols. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Glycols—Twelve commercial glycols and triols are discussed in detail in this 60-page booklet. Information on other glycols and triols available in development quantities is also given. The brochure describes uses and suggested applications. Tabular data include properties, shipping information, specifications, test methods, and constant-boiling mixtures. Thirty-three charts contain useful physical property data. Glycols are used principally as anti-freezes, coupling agents, humectants, liquid coolants, solvents, and resin intermediates. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*



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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 3 mos. 1955*	*Total sales first 3 mos. 1955*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester		
Sheets, under 0.003 gage	5,174,866	4,868,278
Sheets, 0.003 gage and over	3,707,530	3,575,787
All other sheets, rods, tubes	1,903,248	1,704,885
Molding, extrusion materials	21,507,264	20,865,053
Nitrocellulose sheets, rods, tubes	1,261,469	1,409,198
Other cellulose plastics	1,855,371	1,677,734
PHENOLIC AND OTHER TAR-ACID RESINS:		
Molding materials[a]	51,839,472	48,853,126
Bonding and adhesive resins for:		
Laminating (except plywood)	17,100,212	12,032,057
Coated and bonded abrasives	3,274,111	3,702,608
Friction materials (brake linings, clutch facings, etc.)	6,059,667	5,446,780
Thermal insulation (fiber glass, rock wool)	9,344,680	9,773,589
Plywood	11,552,538	9,753,527
All other bonding and adhesive uses	3,493,702	3,649,854
Protective-coating resins	5,514,143	6,056,895
Resins for all other uses	10,383,371	9,566,149
UREA AND MELAMINE RESINS:		
Textile-treating and textile-coating resins	11,277,263	10,798,489
Paper-treating and paper-coating resins	5,394,394	5,235,419
Bonding and adhesive resins for:		
Plywood	23,453,619	21,559,404
All other bonding and adhesive uses, including laminating	6,880,600	7,230,812
Protective-coating resins	8,896,931	6,875,294
Resins for all other uses, including molding	19,324,446	19,182,764
STYRENE RESINS:		
Molding materials[a]	97,172,747	93,598,888
Protective-coating resins	24,742,290	24,159,712
Resins for all other uses	19,951,737	18,730,587
VINYL RESINS, total[b]	165,199,590	161,676,355
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for:		
Film (resin content)		20,949,400
Sheeting (resin content)		13,088,660
Molding and extrusion (resin content)		47,290,605
Textile and paper treating and coating (resin content)[c]		14,743,074
Flooring (resin content)		14,360,696
Protective coatings (resin content)		7,388,089
All other uses (resin content)		11,737,580
All other vinyl resins for:		
Adhesives (resin content)		7,787,328
All other uses (resin content)		24,330,923
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS	60,113,659	60,572,331
POLYESTER RESINS:		
For reinforced plastics	11,550,866	8,982,245
For all other uses	1,111,550	1,386,805
MISCELLANEOUS:		
Molding materials[a, d]	73,259,592	55,149,028
Protective-coating resins[e]	1,120,858	679,139
Resins for all other uses[f]	29,184,180	42,592,471

* Dry basis designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR FEBRUARY AND MARCH 1955 by U. S. Tariff Commission

*February***		*March***	
Production	*Sales*	*Production*	*Sales*
1,557,880	1,536,209	2,096,467	1,911,420
1,087,250	1,119,631	1,418,895	1,428,079
569,860	533,127	765,440	690,386
7,177,347	6,950,739	7,422,246	7,046,427
364,282	431,677	483,053	523,238
558,857	606,509	743,534	597,003
16,345,390	15,218,611	19,287,162	17,717,015
5,933,601	4,059,861	5,841,494	3,979,687
1,068,126	1,182,690	1,226,943	1,330,063
1,938,200	1,746,276	2,418,310	1,913,971
2,997,757	3,066,197	3,545,871	3,719,919
4,395,022	3,673,399	3,810,570	3,099,351
1,080,812	1,105,058	1,274,345	1,295,715
2,279,802	1,924,877	2,597,956	2,197,794
3,436,283	3,440,805	4,054,342	3,511,882
3,288,164	3,394,559	4,189,000	3,875,122
1,763,336	1,821,155	2,088,310	1,928,700
7,680,516	6,791,343	8,856,800	8,337,475
2,029,973	2,090,016	2,506,593	2,823,592
2,887,509	2,184,306	3,176,397	2,454,317
5,914,349	5,857,477	7,315,525	7,431,107
†29,089,219	29,315,737	37,130,688	35,745,732
8,828,063	8,133,571	8,604,501	8,531,184
7,270,514	6,330,022	6,774,473	6,813,338
51,650,358	52,400,339	59,767,437	58,068,156
	6,606,264		8,052,321
	4,204,742		4,429,234
	15,747,702		16,101,543
	4,828,825		5,401,896
	4,812,067		5,208,125
	2,285,463		2,815,044
	3,801,149		4,336,326
	2,352,688		2,858,828
	7,761,439		8,864,839
19,159,530	19,051,034	22,630,619	23,116,836
†3,729,200	†2,908,781	5,032,624	3,890,845
†131,078	†126,075	166,981	262,232
24,714,283	18,308,354	25,674,557	19,294,858
343,997	239,555	338,668	218,546
8,466,658	12,790,406	11,384,360	17,947,225

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. [f] Includes data for acrylic rosin modifications, nylon, silicone, polyethylene, and other plastics and resins for miscellaneous uses.

Portion Package

JUST enough mustard to spice a hot dog or enough ketchup for a hamburger can be gently squeezed out of sanitary, single-portion pouches fabricated by heat sealing of polyethylene-coated cellophane.

As flexible, translucent packages for foods, sauces, relishes, or spreads, the sealed pouches are particularly suited for single-portion serving in restaurants, airlines, hospitals, etc. The handy packages, sold under the name of Custom-Pak, prevent waste and save time in serving customers, and eliminate costly inventory guesswork in maintaining food stocks.

When used for dispensing shampoos, liquid hair preparations, and other cosmetics which must be used in controlled amounts, the unit pouches eliminate bothersome measuring and pre-mixing.

The polyethylene coating on the pouch material gives improved resistance to moisture and most chemicals and imparts better toughness and flexibility properties at low temperatures. Because of the excellent tear, burst, and tensile strengths of the composite film, a perforated notch is provided so that one corner can be quickly and easily torn off to open the pouch.

CREDITS: Custom-Pak units are produced by Custom-Pak, Inc., Cincinnati, Ohio; polyethylene supplied by Bakelite Co.; Cellothene film produced by Cheslam Corp., Yonkers, N. Y.

Unit serving of mustard is squeezed out of polyethylene-coated pouch

Fluorocarbon Pipe

MADE from a fluorocarbon resin and fibrous glass fabric laminate, dip pipes, complete with necessary flanges, packing glands, etc., serve the need for non-fragile, non-corrosive conduit in tanks, reactors, and other types of vessels.

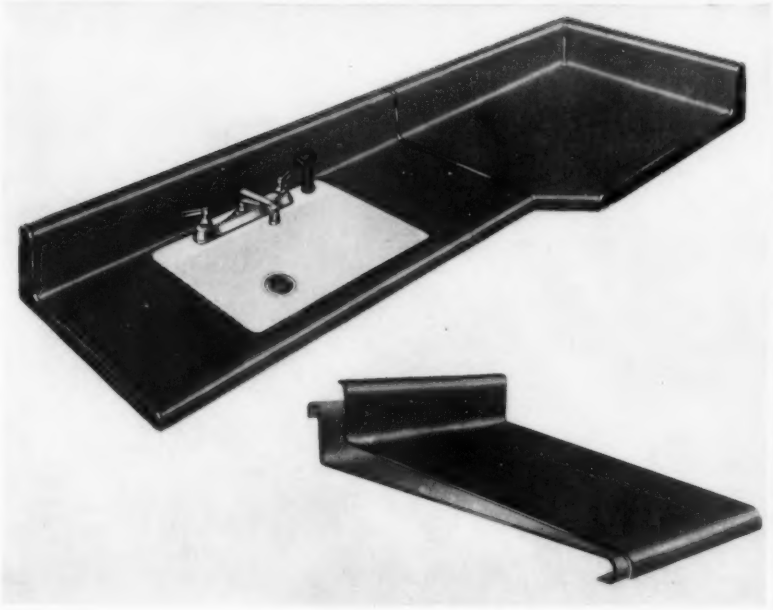
Dip pipes are short lengths of pipe which are used to introduce a second liquid solution into a reaction taking place in a vessel. For those applications where corrosive liquids are involved, the metal or ceramic pipes previously used proved unsatisfactory. The metal pipes would corrode while the ceramic pipes would occasionally shatter, interrupting the processing operations.

The laminated fluorocarbon dip pipe assemblies, in contrast, are chemically inert and impervious to practically all known corrosive liquids. Also, the plastic pipe can be subjected to rough handling or mechanical or thermal shock without damage. The pipes will withstand temperature extremes from —100 to 500° F. and are light in weight for ease in handling.

The pipes are made up of a Teflon resin-impregnated fibrous glass jacket fused over Teflon lining. They are available in stock lengths up to 132 inches. Longer lengths and various special sizes can be fabricated on order.

CREDITS: Dip pipes by Resistoflex Corp., Belleville, N. J.; Teflon supplied by E. I. du Pont de Nemours & Co., Inc.

Non-corrosive, fracture-proof fluorocarbon dip pipe is installed in still



Melamine-impregnated decorative laminate and sheet steel (bottom) are bonded together and postformed into a kitchen work surface that is seamless from front to back

Laminate-Steel Kitchen Counter Top

MELAMINE-impregnated decorative laminate, $\frac{1}{16}$ in. thick, and 16-gage galvanized sheet steel stock are being laminated together and postformed to produce an attractive new type of kitchen cabinet top—completely seamless from the smartly designed rounded front to the swing-up back splash.

The combination of plastic and steel is claimed to offer a number of advantages, particularly in improved strength properties and better heat dispersion qualities. In addition, the laminate surfacing of the new kitchen top effectively resists corrosive liquids, including acids. The laminate will not absorb odors and is tough enough to take all the ordinary punishment kitchen use can give without buckling, chipping, or cracking.

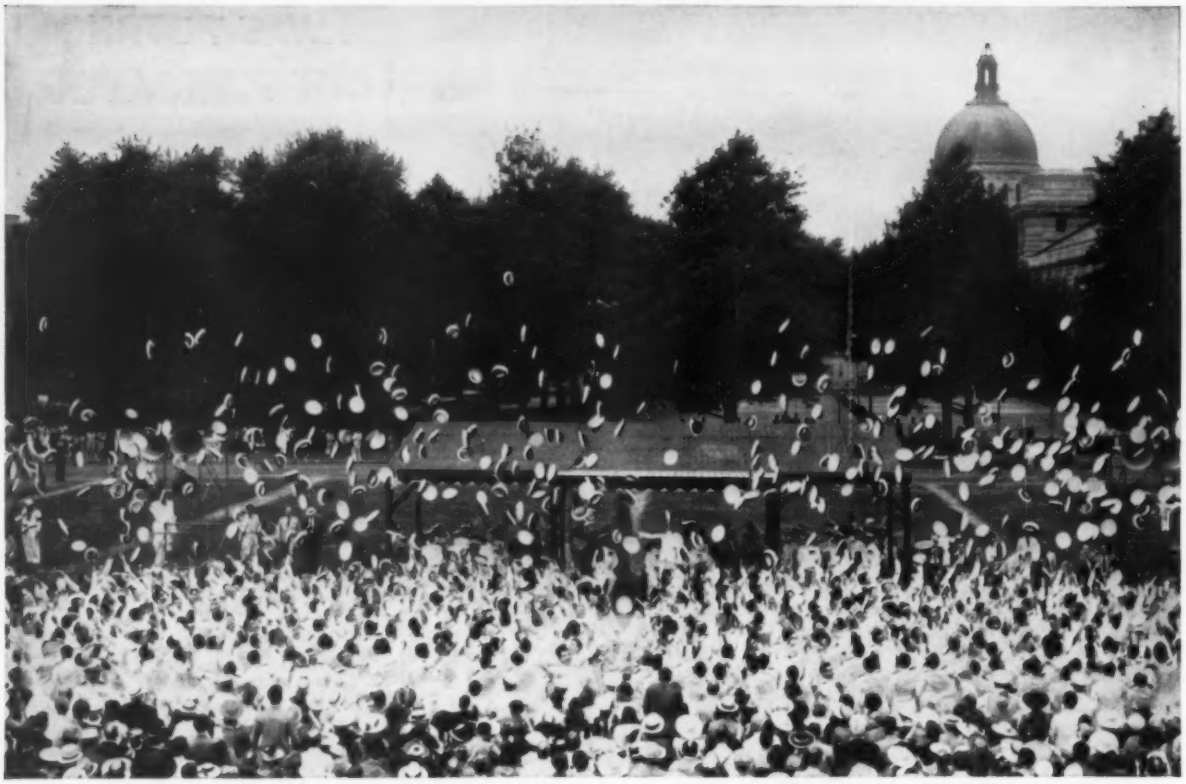
To blend in with modern kitchen color schemes, the laminate is sold in four standard colors and 20 decorator shades that will not fade even after years of use. The natural glossy surface of the laminate can effortlessly be wiped clean using only a damp cloth.

A special feature of the laminate-steel top is its availability for big, open work areas up to 10 ft. in length. The number of seams necessary to join sections together in a normal-size kitchen are, therefore, kept to a minimum. For those installations where a seam cannot be avoided, a special cap strip has been designed that will seal out dirt, dust, or liquids. The ends of the laminate are simply butted together and the snug-fitting cap, which hooks over the top of the back splash and underneath the rounded front of the laminate, is cold soldered in place. End caps are also provided.

The postforming laminate stock and the sheet steel, with a special adhesive in-between are bonded together and formed in one piece under heat and pressure so that they cannot separate. Special postforming equipment is used.

The laminate-steel top can be blanked out to receive sinks and fittings. A special sealing ring which fits around the inside edges of blanked-out area is available for this type of melamine laminate kitchen top. Corner units for L-shaped or U-shaped kitchen assemblies are also available.

CREDITS: Kitchen counter tops made by United Metal Cabinet Corp., Brooklyn, N. Y.; Formica laminate, supplied by The Formica Co., is currently being used; adhesive supplied by Armstrong Products Co., Warsaw, Ind.



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CUSTOM MOLDING SERVICE. Illustrated brochure gives comprehensive picture of the services and facilities offered by this large Midwestern custom converter of plastics materials. Molded Products Co. (G-502)

STRUCTURAL ADHESIVES. Literature outlines composition, uses, curing temperatures, and special properties of family of resin and rubber-base adhesives for bonding rigid plastics, metals, and non-metals. Includes ready-reference comparison chart. Rubber & Asbestos Corporation. (G-503)

HIGH-IMPACT RESIN. Detailed technical report on "Cycolac," a styrene base thermoplastic, enumerates its physical and chemical properties and offers explicit recommendations for its compounding, pigmenting, extruding, molding, calendering, sheet forming, and decorating. Marbon Chemical, Division of Borg-Warner. (G-504)

TRANSPARENT SHEET MATERIALS. Data sheets offer detailed information about the properties and applications of company's line of cast transparent sheet materials. Line includes both thermosetting and thermoplastic varieties possessing a wide range of electrical, optical, physical, and chemical properties. The Polycast Corporation. (G-505)

FASTENING DEVICES. Profusely illustrated catalog provides engineering data, specifications, dimensions, and application data on company's extensive line of fasteners, locking devices, shelf supports, grommets, studs, and inserts. Simmons Fastener Corporation. (G-506)

DRUM TUMBLERS. Folder pictures and describes two tumbling machines: a drum tumbler and a hex barrel tumbler designed for dry color mixing, for part finishing, glass removal, polishing, and color grinding. Units available in several sizes, and with various drive units. Injection Molders Supply Company. (G-507)

EQUIPMENT FOR REINFORCED PLASTICS. Data sheets give pictures and specifications of a roving cutter and of a preform curing oven, the former featuring provision for either compression or open slot cutting, the latter having double oven chambers with a removable partition divider. I. G. Brenner Company. (G-508)

MACHINING LAMINATES. Illustrated manual describes techniques and machinery for sawing, turning, boring, threading, drilling, milling, punching, and gear cutting of high pressure laminates. Synthane Corporation. (G-509)

POLYETHYLENE BAG MACHINES. Folder gives brief description of unit with claimed production rate of 4500 average size bags per hour from plain or printed polyethylene tubing. Will make bags up to 14 inches in width, 27 inches in length. Hilker Products. (G-510)

HEAT SEALING PRESSES. Data sheets describe company's line of rotary, bar, two and four post platen presses for heat sealing thermoplastic film stock. Mayflower Electronic Devices Inc. (G-511)

ADHESIVES. Booklet reviews current and recent developments in the formulation of special purpose adhesives for industrial use. Outlines company's technical facilities for developing bonding and coating compounds. Reviews military adhesive specifications and describes a number of the company's presently available formulae. Angier Products Inc. (G-512)

OVENS. Data sheets describe extensive line of cabinet and batch ovens, gas or electrically fired, in sizes ranging from portable laboratory models to large "walk in" types. Dimensions, specifications, accessory equipment, and prices are included. Grieve-Hendry Company, Inc. (G-513)

HYDRAULIC EQUIPMENT. Text, engineering drawings, and specification tables of this booklet combine in depicting company's line of hydraulic valves and associated cycle controlling devices. The Sinclair-Collins Valve Company. (G-514)

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RADIANT PANELS. Booklet gives specifications of company's line of "Pyrex" radiant glass panels. Describes typical industrial end-uses in drying and heating. Also provides suggested techniques for installation and assembly. Corning Glass Works. (G-516)

POLYAMIDE RESINS. Technical bulletin contains detailed description of company's line of polyamides. Composition, grades, compatibility and toxicity data, applications, and properties are included. Chemical Division, General Mills. (G-517)

PLASTISOLS. Handbook discusses factors involved in plastisols compounding, their preparation and fusion, and details of their use in spread coating, strand coating, metal coating, slush molding, dipping, and mold casting. Recommendations for storage and deaeration after compounding are included. B. F. Goodrich Chemical Company. (G-518)

CEMENTING OF PLASTICS. Manual gives detailed "how to" information on cementing techniques, use of fixtures and clamping devices, types of cement and methods of cement application in assembling and fabricating operations. Plastics Div., Monsanto Chemical Co. (G-519)

BASES FOR MACHINERY. Folder describes facilities of this custom fabricator of steel products with emphasis on firm's specialized skills in the construction of welded machine bases for various types of capital equipment. H. F. Butler, Inc. (G-520)

PREHEATER. Data sheet shows pictures and provides specifications of an electronic preheater for plastics with a capacity of two to three pounds per minute. Unit is on casters; has maximum capacity of ten pounds of compound. W. T. LaRose & Associates, Inc. (G-521)

HYDRAULIC EQUIPMENT. Illustrated catalog provides specifications of company's extensive line of hydraulic pumps, motors, transmissions, cylinders, valves, and pump controls. The Oilgear Company. (G-522)

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PLASTICS FOR ELECTRONICS. Loose-leaf catalog contains technical data on company's line of casting resins, impregnating resins, laminating resins, potting compounds, plastic cements, synthetic foams, and rod and sheet stock having special utility in the electronics field. Emerson & Cuming, Inc. (G-524)

PLASTIC EXTRUSION CONVEYOR. Illustrated bulletin gives general information and specifications of extrusion conveyor table with endless belt. A model with a stainless steel belt to handle high temperature extrusions is also available. Island Equipment Corporation. (G-525)

EXTRUDING EQUIPMENT. Catalog presents photos and specifications of a line of extruders, available in a range of capacities. Oil, steam, and electrically heated machines are available, as well as combination-heated models. Auxiliary equipment and sheet extrusion equipment are also shown. Plastic Machinery Division, National Rubber Machinery Company. (G-526)

CEMENT FOR POLYSTYRENE. Sheet gives characteristics and brief description of "Sty-Fil" transparent cement for bonding polystyrene to itself. Adhesive Products Corporation. (G-527)

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2 AND 3 DIMENSIONAL ENGRAVER. Booklet gives detailed description of "Mico" portable pantograph machine, usable for making small molds or multi-dimensional reliefs. Accessories, including master type, are also described. Mico Instrument Company. (G-529)

MOLDING RELEASE AGENTS. Technical bulletin presents physical characteristics of a silicone mold release agent. Manufacturer claims this emulsion is exceptionally stable, has good shelf life, gives molded parts a superior surface finish. Dow Corning Corporation. (G-530)

COMPRESSION MOLDING OF REINFORCED PLASTICS. Reprint of article from MODERN PLASTICS magazine gives details about production of molded reinforced plastics parts on a high output basis. Many photos of production steps are shown. Molded Fiberglass Body Company. (G-531)

COATED ABRASIVES FOR PLASTICS. Illustrated manual describes methods for using coated abrasives in the plastics industry. Also includes a reference chart of sanding practices to be followed in finishing, applicable to the 69 plastic materials listed. Behr-Manning, Division of Norton Company. (G-532)

GLASS FIBER LAMINATING MATERIALS. Leaflet shows photos of applications and describes characteristics of a line of glass fiber reinforcing materials, available in both roving and yarn forms. Textile Division, Glass Fibers, Inc. (G-533)

POLYESTER RESINS FOR ELECTRICAL APPLICATIONS. File folder contains many technical data sheets giving details of characteristics and properties on a line of polyester resins designed for electrical and electronic applications. Materials can be used in casting, potting, impregnating and dip-coating operations. H. H. Robertson Company. (G-534)

TROUBLE SHOOTERS GUIDE TO POLYESTER MOLDING. Booklet describes ten common molding defects, discusses possible causes, and gives suggested remedies. Resinous Products Division, Rohm & Haas Company. (G-535)

POLYSTYRENE FOR LIGHTING FIXTURES. Literature gives technical data, mechanical advantages, optical advantages, and light transmission characteristics of "Evenglo," specially pigmented white polystyrenes, designed for lighting applications. Chemical Division, Koppers Company, Inc. (G-536)

PYROMETER CONTROLLER. Specification sheet on a pyrometer controller of the potentiometer signalling type which is available in a selection of standard scales ranging from 0-600° F. to 0-3000° F. Thermo Electric Co. Inc. (G-537)

INFRARED LAMPS. Literature gives specifications and heating and drying characteristics of line of thirteen infrared radiant heaters. N. J. Thermex Co. Inc. (G-538)

HIGH-SPEED SAWS FOR PLASTICS. Folder on "Radialloy-tipped" circular saw blades, ranging in diameter from eight inches to sixteen inches, for cutting "Lucite," "Plexiglas," molded phenolics, "Micarta," "Formica," and most other plastics. Radial Cutter Manufacturing Co. (G-539)

DIAMONDS FOR MOLDS AND DIES. Bulletin compares advantages of diamond compound and diamond powder for grinding and polishing molds and dies. Describes DTR diamond compound kit. Price list included. Diamond Tool Research Co. Inc. (G-540)

FILM PROCESSING MACHINERY. Company offers catalog showing complete line of equipment for polishing, embossing, and other plastics production operations. Discusses single units to do one or a number of these jobs. Liberty Machine Co., Inc. (G-541)

NYLON COST CALCULATING. Folder provides information to help calculate material cost of nylon part for comparison purposes. Costs are determined by part's volume in cubic inches. Typical example shows how proper part design yields savings. Nylon Molded Products Corp. (G-542)

LOW PRESSURE MOLDING PRESS. Literature shows and gives detailed description of "Bipel" low pressure molding press for reinforced plastics. Provides complete pressure range selection from 10 to 50 tons. B. I. P. Engineering Ltd. (G-543)

PLASTICIZERS. Large catalog describes line of 20 plasticizers. In each case, gives specifications, average properties, suggested uses, test data, efficiency percentages, and standard quantities available. Ohio-Apex Inc., division of Food Machinery and Chemical Corporation. (G-544)

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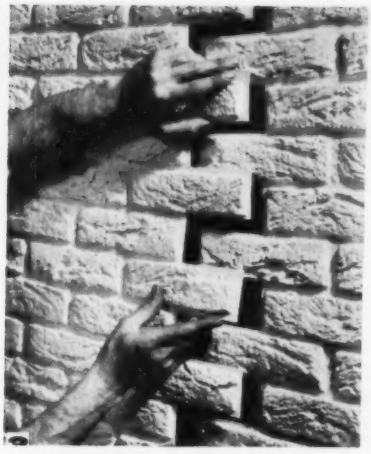


Vinyl wall coverings, formed into raised brick pattern, are easily applied

Wall Covering

RIGID vinyl sheets, vacuum formed into realistic three-dimensional brick and stone patterns, are the latest innovations in plastics wall coverings for the do-it-yourself market.

Called Decro-Wall, the 2- by 4-ft. lightweight sheets are available in six different surface patterns—all authentic in texture, shape, and color. To install the covering, adhesive is first applied from a tube to the back of the sheet along the depressed areas which simulate the mortar lines around each brick and the sheet is then pressed against the wall surface.

To fit the sheet around windows, cabinets, or doors, it can be cut with ordinary household scissors. Alternate half bricks at either end of the sheet are pre-cut so that they can be removed to permit adjoining sheets to interlock for better alignment.

The tough, easy-to-clean vinyl covering is grease and stain resistant. Dead air pockets in the ¼- to ½-in. open space behind the raised "bricks" provide insulating and sound absorbing characteristics and reduce heat conduction through the wall. The confined air plus the natural resiliency of the vinyl sheet also provides a safety factor when the covering is used in playrooms or bathrooms.

CREDITS: Decro-Wall coverings are a product of National Vacuum Molding Corp., Yonkers, N. Y.

Nylon cup for soil testing equipment withstands rough field use

Nylon Soil Cups

SOIL cups molded of nylon are used in conjunction with a portable conductivity bridge to measure soil fertilizer content—one of the properties which determines for the farmer which method of crop control to select.

Basically, the device is designed to determine the total soluble salt or fertilizer content of the soil by measuring the electrical conductivity of either a moistened sample or a water extract of the soil. The moistened sample is simply packed into the molded nylon cup which is mounted on a separate panel connected to the conductivity bridge. A meter on the face of the bridge gives an instant reading of the conductivity of the sample of soil that is being tested.

The manufacturer of the unit only recently switched to nylon for the construction of the soil cups, primarily because of the ability of nylon to withstand considerable rough field use without bending, warping, or cracking. According to the manufacturers of the measuring device, the appearance and styling of the nylon cup also make for a neater, more compact, more attractive unit.

CREDITS: Zytel nylon supplied by E. I. du Pont de Nemours & Co., Inc.; cups molded by Industrial Devices, Inc., Edgewater, N. J. for conductivity equipment manufactured by Industrial Instruments, Inc., Cedar Grove, N. J.

Flagged monofilaments make

Better Brushes

SOFTER and more efficient brush bristles can be produced by using a new type of monofilament, based on Bakelite styrene, that splits into dozens of branches when the tip is struck a sharp blow.

Brushes made with the burst-tipped or flagged fibers are claimed to have a denser work surface and to be less stiff than brushes using bristles of ordinary styrene monofilaments of the same diameter. In addition, the softness of the burst-tip brush fibers prevents visible scratching of glossy or highly polished surfaces and provides a more effective sponging action than is possible with stiff-bristled brushes. The flagged fibers are also claimed to sweep cleaner since the fine hair ends offer a greater area for electrostatic charges to adhere dust particles to the brush.

The styrene formulation from which the flaggable monofilaments are made resists abrasion, as well as the chemical action of soaps and detergents.

CREDITS: Flaggable monofilaments produced by Mack Molding Co., Arlington, Vt.; styrene plastic supplied by Bakelite Co.

Styrene monofilament (left) splits up (right) when its tip is struck

Flagged fiber bristles (right) sweep cleaner than ordinary bristles (left)

Paring Costs

(*From pp. 73-77*)

der to which a blank sheet of cellulose acetate, called "Scan-A-Plate," has been mounted. The two cylinders are synchronously driven. Impressions, corresponding to the light and dark areas of the original photo, are burned into the plastic blank by the heated stylus, producing a series of dots similar to those comprising a regular halftone engraving.

Among the companies which have been most active in the commercial production of plastic halftone plates by the Fairchild process is the R-K Engraving Co., Ardmore, Pa. This firm, it is reported, was the first engraving company to offer the graphic arts field a complete plastic halftone service in a choice of three screens—85, 100, and 120. Advantages claimed for the R-K plastic halftones include a high standard of quality, speed in production, and important savings.

According to R-K Engraving Co., it is possible to produce plastic halftones by this method which are comparable to copper halftones in reproduction quality. As in the production of metal plates, the "copy" or photo can be enlarged or reduced to the desired dimensions without loss of tonal values or detail. The R-K plates are etched as deep as average metal plates and undercutting is impossible because of the method employed. The durability of these halftones is attested by the fact that actual press runs of 60,000 to 100,000 impressions have been reported without appreciable signs of wear. Many printers report that because of their resiliency, the plastic plates actually require less "make-ready" on the press than metal plates.

Somewhat similar in operation to the Scan-A-Graver is the Engrav-a-Plate machine, manufactured in Germany and distributed in the U. S. by the Consolidated International Equipment and Supply Co., Chicago. (See MODERN PLASTICS *31*, 114, April 1954). A companion unit for line engravings, the Engrav-a-Line machine, works on the same principle.

On both types of machines, the copy to be reproduced is placed in the machine face down. A pressure plate is placed over the copy and a sheet of hard vinyl plastic is locked on the pressure plate. Operation then proceeds automatically.

Finally, there is the use of plastics in connection with electrotypes. Many large publications which require a large number of electrotypes to meet production requirements make use of sheet plastic intermediates which facilitate electrotype manufacture, reduce costs, and eliminate storage of tons of metal.

In the production of electrotypes, the process starts with a plastic duplicate of the original type and engravings, produced on a molding press. Among the thermoplastic sheet materials used for this purpose are Vinylite and Monolite. The former is a pressed, planished vinyl sheet, while the latter is a calendered sheet. Also widely used for this type of work is another vinyl sheet produced by Tenak Products under the name of Tenamold.

Monolite sheeting, a special vinyl sheeting made by Bakelite and distributed by The Monomelt Co., is representative of these materials. Green in color for ease in inspecting and cleaning the molds, it is supplied

in a standard sheet size of 24 by 48 in., in thicknesses of 0.030, 0.035, and 0.040 in., matte finish both sides. Following a preheat period, the material is transferred to the molding press and the proper pressure immediately applied.

After stripping from the form, the Monolite mold is prepared for plating. This involves sensitizing it with a solution of stannous chloride, followed by a clear water rinse. Next, the sheet is transferred to a stopping-off rack and sprayed with silver solution, after which a thin strip of lead or copper is stapled to the base of the silvered mold to provide an electrical connection. Sheets are then hung in regular plating vats, where they receive a deposit of nickel varying in thickness from 0.001 to 0.002 inch. Next they are transferred to another section of the vat for deposition of a copper shell ranging from 0.008 to 0.012 in. thick, depending upon printing requirements. The complete plating operation requires from 2½ to 4 hours.

Following the plating process, the vinyl forms are stripped from the copper shells and the operation repeated if additional shells are required. The plastic forms, if not released for another electrotyping cycle, may be conveniently filed for future use.

Requiring little storage space, the sheet vinyl electrotype forms make it possible to eliminate the storage of tons of type metal and engravings and reduce the storage job to a routine filing operation.

Most recent contribution of plastics to improvements in electrotypes also reduces weight, but in a different way. In the "Color-Line" process, developed by Printing Plate Supply Co., Chicago, Ill, Geon rigid vinyl sheet is used instead of the conventional heavy lead for backing-up thin electrotype shells. Such printing plates are reported to be extremely light, accurate, and strong, and have other advantages.

The backing material consists of a 0.020-in. vinyl sheet, fabricated by Nixon Nitration Works, Nixon, N. J., bonded to a perforated aluminum base. The electrotype is placed, printing face up, on top of the vinyl and the assembly, after heating to soften the plastic, is placed under pressure in a cooling press. The softened plastic material conforms to the surface variations of the back of the electrotype shell; excess is forced out into the holes in the aluminum plate and the result is an extremely level plate.

In Brief

Thus plastics bring improved methods for putting ink on paper to the art and science of printing. The improvements bring about better reproduction of type and illustrations, substantial savings in weight and bulk, and speedier printing, and shorten the interval between the last stroke of the editorial pencil and delivery of the printed work.

Several of the plastics printing aids described are in use at Hildreth Press, where MODERN PLASTICS Magazine and the annual Encyclopedia Issue are printed. Much of the color reproduction is regularly accomplished with vinyl plates, produced rapidly and accurately to specification. By employing such time- and cost-saving methods, it has been possible to step-up printing quality without curtailing volume or sacrificing layout appearance to keep production economics within reasonable limits.—END

Better Bodies

(*From pp.* 78-80)

the mold are removed. The one-piece body can then easily be snapped out of the remaining center section.

Finishing Operations

The cured body is next passed on to the finishing line where it is first sanded down and holes are drilled to accommodate various accessories.

A prime coat of paint sprayed over the outside surface of the unit brings out any minor body imperfections, particularly along the parting lines of the three sections of the mold. After sanding these imperfections, two more coats of paint are sprayed on and the finished body is shipped for final finish and assembly.

At the PowerCar plant, a final coat of turquoise blue paint is applied. After installing the steering wheel, electric sealed-beam headlights, racy electric tail lights, and various dashboard accessories are inserted into the openings cut for them in the reinforced plastics body and locked in place.

Since the car is low enough for the youngster to step into it over the side, door outlines are simulated by indented lines molded into the plastic body. A deep groove molded into the back of the one-piece body simulates the outline of a trunk.

The plywood seats are upholstered with vinyl film embossed with an attractive antique leather finish and a textured styrene copolymer sheet serves as a side panel.

After installing the motor, the completed body is mounted on the chassis—ready to roll!

Formed Vinyl Body

The formed vinyl Kaiser-Darrin, Jr., body represents another achievement in plastics engineering—the result of close cooperation between designer, material supplier, fabricator, and end-user. From the standpoint of other toy manufacturers, its success points the way to the use of the forming technique in other phases of wheeled goods construction.

Decision to form the Kaiser-Darrin, Jr., body over dies was reached after experimenting with several

plastics and conventional metal fabricating techniques. According to Kaiser-Willys, the forming method offered several advantages. For one, by using inexpensive cast phenolic dies, fine detail could be reproduced in the formed body without incurring heavy tooling costs. The time element was also an extremely important factor. Faced with rigid specifications and a limited time schedule, the fabricator decided that the fastest and least expensive method would be to vacuum form the bodies from rigid plastic sheet.

Rigid vinyl was selected as the sheet material primarily because of its high impact resistance, the wide range of integral colors in which it is available, its rigidity, and the speed with which it can be formed. In addition, if the car body should become damaged in any way, it could easily be repaired by welding with a hot air gun.

Two-Piece Construction

The original Kaiser-Darrin, Jr., bodies were made in two parts because the largest vinyl sheets available from the material supplier at the time were 48 by 72 inches—not quite large enough for a one-piece job.

The vinyl sheet, however, is now available in much larger sizes from which the body could be formed in one piece, cutting fabrication time in half and eliminating a riveting operation.

Fabrication Process

The production line which was set up by Kaiser-Willys and the fabricator for making the two-piece body, however, indicates the basic simplicity of the operation.

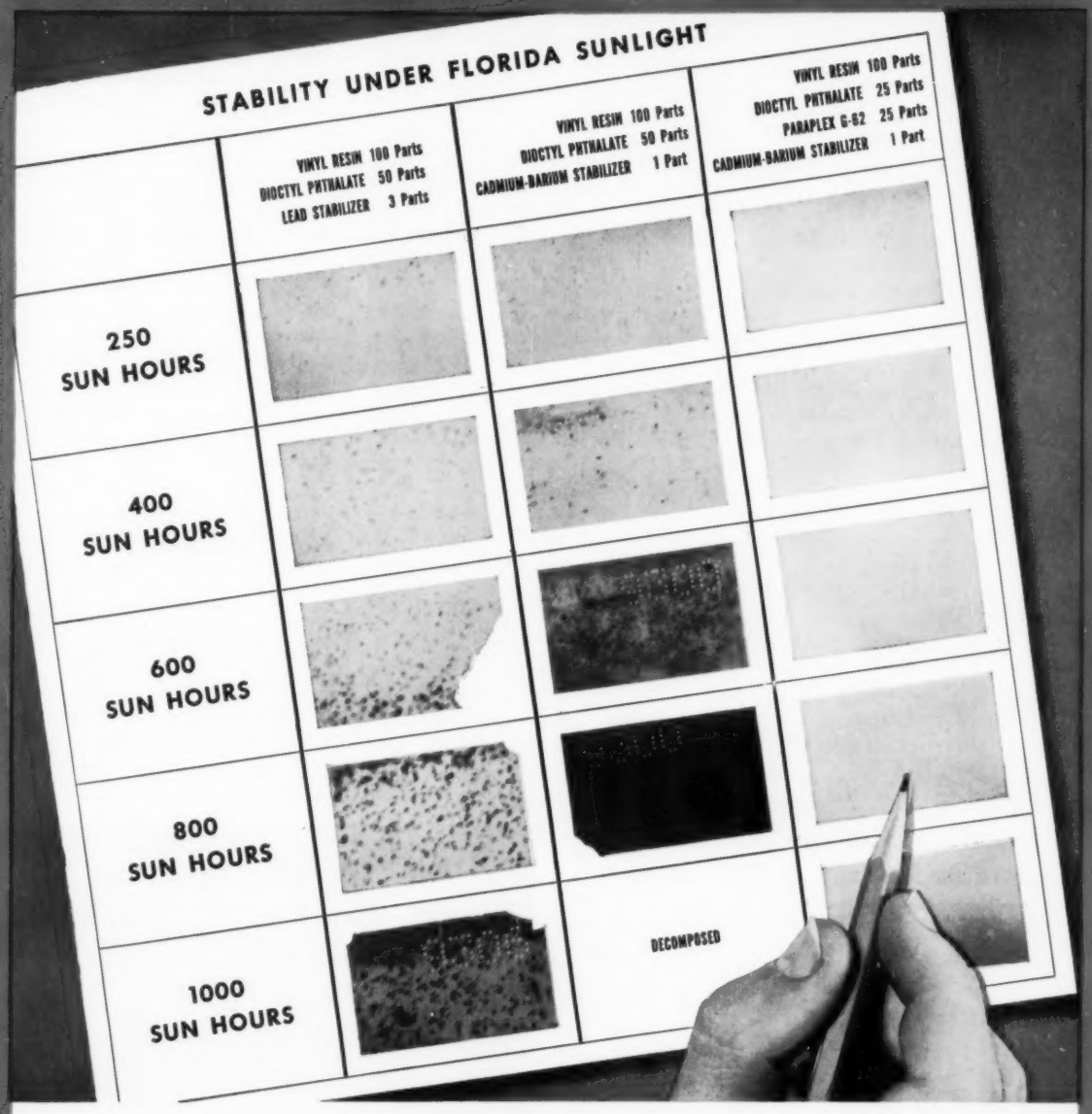
The original clay prototype of the Kaiser-Darrin, Jr., was sculptured at Kaiser-Willys following the sleek styling of the adult-size model as closely as limitations of sheet size, depth of draw, and vacuum return would permit. From this clay model, a plaster cast was made; first of the front half of the body and then of the rear half, and from these two plaster molds the two phenolic production dies were cast.

The fabrication process was also relatively simple. The precut vinyl sheets were first heated in a forced air oven for 8 min. at 310° F. One heated sheet was then transferred to the forming die for the front half of the car and the other sheet to the die for the rear half of the car. Each sheet was laid in a frame across a wooden box into which the phenolic die descends. Banks of infra-red lamps were used on both sheets to spot-heat difficult undercut sections. The vacuum was then pulled, sucking the heated sheets up against the descended dies.

The function of the wooden box is to provide an air-tight seal between the sheet and the die so that the vacuum can work more effectively for undercut sections. The cockpit area for both the front and back halves of the car is pushed in by a wooden form located within the wooden box. This form is flocked to prevent the sheet from being scarred.

The formed halves are then air cooled, removed from the die, and riveted together. The riveted joint corresponds to the door joint in the adult-size Kaiser-Darrin.

The completed body is then



Florida Sun Proves Value of Paraplex G-62

The stabilizing effect of PARAPLEX G-62 in vinyl compounds was dramatically demonstrated during recent tests under intense Florida sunlight. The samples shown here were exposed for periods ranging up to 1000 sun hours. The improvement imparted by PARAPLEX G-62 is clearly shown by the exposed samples.

In other tests in the field, as well as by Weather-Ometer, Fade-Ometer, and 450°F. oven tests, the results were similar: outstanding resistance to embrittlement and discoloration when PARAPLEX G-62 plasticizer-stabilizer was used.

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screwed to the wood chassis frame. Stainless steel molding covers the heads of the screws where they are visible on the exterior of the car body. Metal bumpers, steering wheel, dashboard accessories, and painted-on headlights and taillights complete the assembly.

The body of the Kaiser-Darrin, Jr., is champagne white and the cockpit is in contrasting red. Engineered front suspension and the light weight of the vinyl body—it weighs only 14½ lb.—combine to assure easy, positive control for the junior driver. Two-wheel front brakes and semi-pneumatic rubber tires also contribute to riding performance.

Amusement Park Autos

For the same reasons that the toy industry has displayed such interest in plastics toy car body—strength, light weight, eye-appeal, and ease and economy of fabrication—Alan Herschell Co., North Tonawanda, N. Y., has installed reinforced plastics bodies on miniature gasoline-driven sports cars for amusement park "U-drive-it" concessions. The strength of the polyester-fibrous glass laminate and the ease with which it can be repaired make plastics ideal for this use because the small autos are generally subjected to more than normal abuse.

The bodies are fabricated in one piece, using a female reinforced plastics mold made by the contact lay-up method from an original plaster type model. Production involves use of room-temperature catalysts to enable curing without heat or pressure.

After cure, the body is trimmed, sanded down, primed, and painted. Headlights and grilles are assembled to the 50-lb. body by screws and bolts and the trunk lid, which is a separately molded reinforced plastics part, is fastened with concealed hinges. Twelve bolts hold the body securely to the chassis.

The three miniature toy autos described above have met with considerable success; this, coupled with extensive publicity, has stimulated a great interest in the potentials which they represent. One toy manufacturer confidently feels that they are the beginnings of a revolutionary approach to toy design.

With improved materials and fabricating techniques, costs may soon be lowered sufficiently to permit all-plastics car bodies to favorably compete price-wise in the mass market for at least the larger toys. When and if that time arrives, Junior is going to be treated to some of the most exciting new playthings of all times, the toy industry is going to enter a new era . . . and the plastics industry is going to have another profitable, high-volume market for its materials.

CREDITS: Body for the Thunderbird, Jr., is fabricated by Steiner Plastic Mfg. Co., Inc., Glen Cove, N. Y., using fibrous glass supplied by Owens-Corning Fiberglas Corp., New York, N. Y., and polyester resins supplied by The Glidden Co., Cleveland, Ohio. Body for the Kaiser-Darrin, Jr., is formed by K-Plastix, San Francisco, Calif., using Seilon sheet made by Seiberling Rubber Co., Akron, Ohio, from Geon vinyl resins supplied by B. F. Goodrich Chemical Co. Amusement park car body is fabricated by Atlas Plastics, Inc., Buffalo, N. Y., using Rovecloth fibrous glass cloth woven by Hess Goldsmith & Co., Inc., New York, N. Y., and polyester resins supplied by American Cyanamid Co. and Marco Products Dept., Celanese Corp. of America.

Functional Plastics

(*From pp.* 83-84)

plastic part, so mounted that it automatically moves back and forth on a horizontal metal support until in line with the proper record, has the additional advantage of forming its own bearing. It has a maximum wall section of $\frac{5}{16}$ inch.

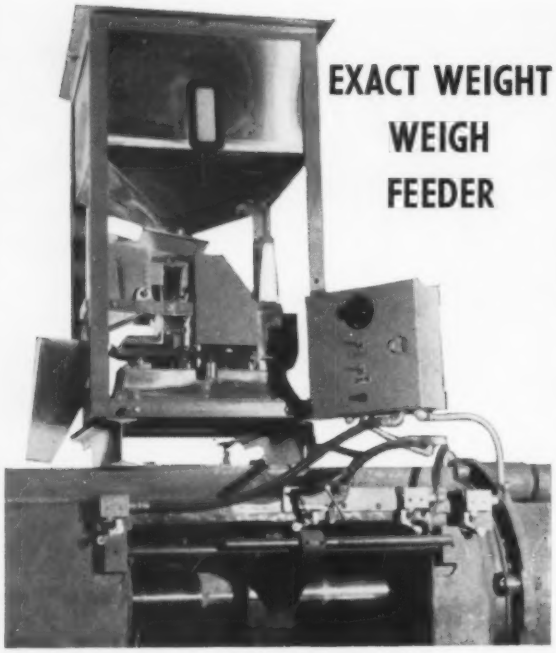
The phenolic laminate helical gear, driven by a metal worm, powers the main motor shaft of the phonograph. The stock used is canvas bonded with phenolic resin. The plastic material was selected for this application because of its excellent wearing qualities and the fact that such gears are quieter in operation than when made of metal. The plastic gear also requires only a small amount of graphite lubrication.

"Two-Shot" Molded Keys

In order to provide a choice of 100 recorded selections, the Se'ect-O-Matic makes use of 20 selector buttons, divided into two groups of 10 each. The left set of buttons is identified by letters running from A through K, while the right bank of buttons carries numbers from 1 through 10. To make a selection, the patron drops a coin into the coin receiver, then presses the desired combination of buttons, such as A-7, C-4, etc. The large, easily operated keys, with slight depressions to fit the finger tips, are molded of red and white cellulose acetate butyrate by a patented "two-shot" injection process. Because the red numbers and letters are molded directly into the keys and are locked in by the white butyrate which comprises the second molding shot, the keys will give many years of service without obliteration of the markings. A molded slot-and-groove arrangement at the bottom of each key provides attachment to the control panel linkage by means of metal spring clips.

Strips of rigid Vinylite sheeting are used for the long selection guide which mounts above the record magazine and for the five-record classification headings that fit beneath a die-cast metal frame and facilitate patron selection by dividing the records into "Hit Tunes," "Old Favorites," etc.

For the large strip, behind which the phenolic mounting block with



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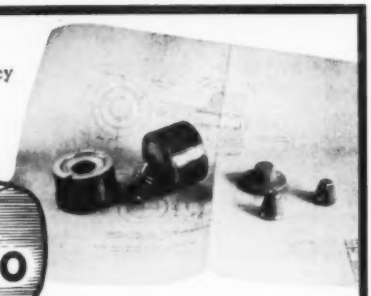

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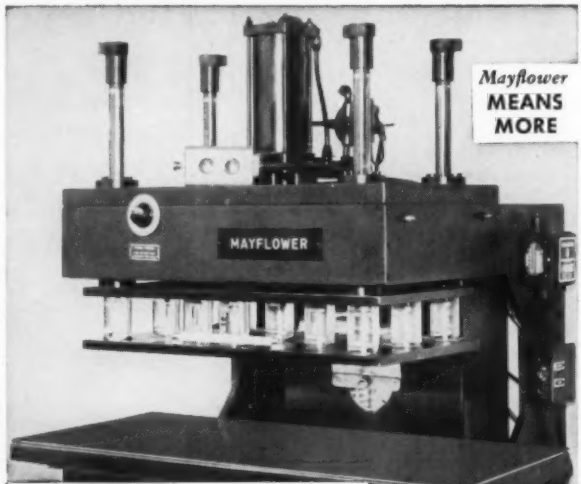

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its two small light bulbs moves for spot illumination, the fabricator utilizes white translucent vinyl material in 0.030 in. thickness, silk screening the record designations on the front surface of the material in blue. In making the classification headings, the fabricator works with 0.025-in. transparent sheeting, silk screening in reverse with blue to produce the necessary markings and following up with a white background color.

Held by Magnets

Both types of strips have punched openings which locate them accurately when they are mounted in the automatic phonograph. The metal frame which holds the classification headings and individual paper selection strips in place is itself held in position by magnets, making it easy to remove for selection changes.

Servicing of the record player unit is made more convenient by designing it so that the entire assembly can be slid forward by the service man.

The entire record playing mechanism is enclosed within a glassed-in compartment at the top of the machine. Access to the mechanism is afforded by hinging the curved glass front at the top, so it can be raised like an automobile hood. Plastic veneer, in two attractive wood grain patterns, is used for trim on the wooden side panels of the cabinet. A light diffuser strip, molded of blue regular styrene, helps to provide a decorative lighting effect for the lower part of the cabinet, where structural glass columns and plated metal strips are used in combination with metallic grille cloth.

CREDITS: Carriage cover and end bells molded of Dow and Monsanto medium-impact styrene by Modern Plastics Corp., Benton Harbor, Mich. Acrylic decorative escutcheon and record guard, styrene end bell caps, and styrene light diffuser molded by Victory Mfg. Co., Chicago, Ill., using Plexiglas and Lucite acrylic and Dow, Koppers, and Monsanto general-purpose styrene. Vacuum plating of escutcheon by B & T Plastic Finishing Co., Chicago, Ill. Double shot selector buttons molded by Electric Mfg. Co., Inc., San Francisco, Calif., using Tenite II butyrate material. Record selection and classification heading strips printed and fabricated by N. D. Nelson, Inc., Chicago, Ill., using Vinylite sheet stock. Helical drive gear made by Gear Specialties, Inc., Chicago, using Bakelite phenolic-canvas laminate stock. Phenolic mounting block molded by Peerless Molding Co., Toledo, Ohio, using general-purpose phenolic material. Plastic veneer for cabinet trim, Meyercord, Co., Chicago, Ill.

Smaller Timer

(*From pp.* 88-89)

laminate housing, the terminal block is made in one piece to minimize parts inventory. The one-piece construction also serves as a more effective insulating barrier, eliminating any joints or slots for possible arcing over an air gap between conductors.

With the exception of four assembly holes which are tapped in, all of the openings in the terminal block, including those to accommodate the 10 terminals, are molded in. Protective 270° arc barrier partitions facing the rear of the block are molded around each terminal for greater safety.

A relay contact block located in front of the terminal block is also molded of fibrous glass-reinforced alkyd.

Setting Device

The large knurled knob which turns the time-set pointer, is molded of phenolic. A molded-in metal insert in the back of the knob fits around the end of the shaft on which the pointer is mounted.

Between the knob and the front of the acrylic dial face and between the back of the face and a circular metal disk on the end of the pointer shaft are two Teflon washers. According to Automatic Temperature Control Co., Teflon was selected for this purpose because it is self-lubricating, compressible enough to make a good seal, and provides sufficient tension to hold the pointer in place.

Inserted into the hollow pointer shaft is a cylindrical nylon torque tube with one end flared out to rest against the bottom half of the time-set pointer. When the pointer is released after it has reached the set time period and returns to "zero" position, the nylon torque tube serves as a shock absorber in cutting down the amount of bounce and consequently the time which the pointer takes to settle down. The timer can thus be reset almost immediately at the end of a timing sequence.

Because of the many operational advantages which result from the use of plastics parts in the internal mechanism of the timer, the unit can be used for a wide variety of industrial process, laboratory, and machine automation jobs.—END

Era of Decision

(*From p.* 85)

sumption of malt beverages on the upswing; while spectator amusements, railway transportation, motion picture admissions, and consumption of distilled spirits are on the downswing.

There are 67% more children under 5 years of age than there were in 1940 and there are 53% more persons over 60 years of age.

Low point in persons entering the adult market was in 1954. Beginning in the present year the number of persons reaching voting age and family formation age will expand rapidly.

Home ownership continues to advance but there is a steady and rapid drop in farm population, which has not resulted in lowered farm production. Plastics should find increased market opportunities both in farm production uses and in the farm home of improved living standards.

Tastes, incomes, education, and modern needs have so changed that pressure of obsolescence can be far more important to new housing needs than pressure of additional population. Pressure will continue for suburban shopping centers and for multiple car ownership among suburban families.

Intelligent selling should be able to convert annually at least 10% of 11 million prime two-car prospects into customers—another annual market for over one million cars additional.

In 1956 there may be 6½ times as many consumer spending units with incomes over $3000 as there were in prewar 1941.

We must sell $40 billion more goods and services to consumers in 1955-1956 to assure a continuing expansion in our national economy, just to keep up with our growing productivity.

A production goal of $500 billion has been set for 1965. A growth of this sort in the American market can have a powerful impact on world trade and on the standard of living of the other free nations of the world. These facts, as presented, show that markets have changed, are changing now, and will continue to change rapidly in the future.

The Autonomy of the Consumer,

by George Katona, director of the Economic Behavior Program, Survey Research Center, Univ. of Michigan.

Over the past decade there has been a change in the appreciation by marketing men of the role of the consumer as an economic factor. Previously consumer behavior was thought to be dependent on forces beyond the influence of the consumer, such as disposable income, business investments, government budgets, cost of living, etc. But it is now becoming evident that consumer spending is not a function of income and resources alone, but may change according to changes of consumer motives, attitudes, and expectations. We know now that the consumer at the opening of the Korean war believed we were entering World War III; he started to hoard. An important point is that changes in consumer attitudes occur prior to changes in the rates of consumer spending.

It has likewise been found in recent years that consumer attitudes are quite rational, not unpredictable, if sound study is made. For example, many people buy automobiles and durable goods on installments while they have cash in the bank and could make the purchase without borrowing. That might seem to the consumer's disadvantage because he is paying higher interest rates than he is getting. But buying on installments compels him to save while after buying for cash rather than on time, there would be no strong compulsion to build up the bank account again.

Economists traditionally assume that if people expect prices to go up they will hasten to buy; but if they expect prices to go down they will postpone buying. For example, if prices are going up the consumer may delay the purchase of an automobile because she knows that she will have to pay more for meat and milk later on, and, therefore, will have less money to buy other things. A rise in price frequently causes consumer resentment and buying resistance.

The consumer serves as a stabilizing factor in business. In 1948-49 for instance, while businessmen thought they were over-inventoried, the consumer remained optimistic and continued to buy; thus a recession was arrested. In 1953-54 when govern-

ment expenditures were cut following the truce in Korea another recession was in the making, but with the help of some tax reductions the consumer again increased his standard of living with stabilizing effect.

An important task for business is to study the origin of consumer attitudes. By such study, businessmen can make decisions which contribute to their own and the country's economic progress.

Formed Sheet Session

The Friday morning, May 13, session was under the chairmanship of Hiram McCann, editor of MODERN PLASTICS Magazine. The session was devoted to discussions of various aspects of formed thermoplastic sheet. The following papers were given:

V. LeRoy Kiernan, vice president, Panelyte Div., St. Regis Paper Co., spoke on "Markets for Formed Thermoplastic Sheets." John Bachner, executive vice president, Chicago Molded Products, spoke on "Thermoplastic Sheet Materials." Sanford S. Zimmerman, president, Vacuum Forming Corp., spoke on "Machines and Methods for Thermoplastic Sheet Forming." Copies of these papers are available through the Public Relations Office of The Society of the Plastics Industry.

The May 13 afternoon session was addressed briefly by William T. Cruse, executive vice president of S.P.I. and by Charles Condit, technical secretary of the Society, who presented an informal report on the effects on plastics material, so far determined, of a recent atomic test blast in Nevada. A full, formal report of this test awaits declassification.

Informative Labeling Award Presentation

Announcement of the winner in the first S.P.I. contest to be judged solely on the merits of an informative label and the presentation of the award was one of the features of the cruise-conference. The competition was part of the Society's public relations program to promote a better understanding on the part of the consuming public of different plastics materials.

John J. O'Connell, S.P.I.'s president, presented the Informative Labeling Award to the winner, American Cyanamid Co., for informative

labeling on Melmac molded melamine dinnerware.

Honorable mentions were given to six additional companies for excellence in their informative labeling. In the housewares category these were Federal Tool Corp., Chicago, Ill., for a breadbox label; and Alladin Plastics, Inc., Los Angeles, Calif., for an all-purpose utility basin label.

The contest was open to everyone interested in the plastics industry and was judged by leading New York authorities in consumer merchandising, including representatives of the daily press, consumer magazines, business publications, and retail and merchandising associations.

New Officers

Outgoing President John J. O'Connell presented his personal report of stewardship and the annual elections of the Society took place with the following results:

Director and chairman of the Board—John J. O'Connell, Consolidated Molded Products Corp.; director and president—Norman Anderson, General Molded Products, Inc.; director and vice president—Alan S. Cole, MODERN PLASTICS; director and secretary-treasurer—William C. Bird, Prolon Div., Pro-phy-lac-tic Brush Co.; sectional directors—Canadian Section—F. G. Rice, Du Pont Co. of Canada, Ltd.; Midwest Section—Robert W. Jorgensen, The Richardson Co.; New England Section—C. J. Cowan, Cowan Boyden Corp.; Pacific Coast Section—K. R. Mergen, Crest Molded Products, Inc.; Industry Division Directors—Button—Frank Parizek, The Frank Parizek Mfg. Co.; Engineering and Technical—N. J. Rakas, National Automotive Fibres, Inc.; Extruders—Walter E. Jacobson, Yardley Plastics Co.; Film and Sheeting—Bernard Mittman, Elm Coated Fabrics Co., Inc.; Machinery—F. C. Means, The Fellows Gear Shaper Co.; Mold Makers—Lionel B. Kavanagh, Standard Tool Co.; Molder Management—Ven W. Rau, G. Felsenthal & Sons, Inc.; Reinforced—Samuel S. Oleesky, Micronics, Inc.; Wall Tile—H. A. Lamont, Jones and Brown, Inc.; Directors at Large—C. W. Blount, Bakelite Co., Div. of Union Carbide and Carbon Corp.; William Lester, Pyro Plastics Corp.; Raymond B. Seymour, Atlas Mineral Products Co.—END

Form it or Mold it?

(*From pp.* 86-87)

must be appraised on the basis of what *can be* done rather than what *has been* done.

Such considerations must look to the end product. Does the finished part from each process meet specifications, and how do the parts compare in cost? Physical characteristics should be considered first; which process will most consistently give physicals closest to the optimum of the material? The answer must be qualified to some extent, but experience shows that, pound for pound, the vacuum formed panel has the greater strength.

Is this because it has fewer internal strains and no weld or flow lines, and is this something that cannot be controlled in injection molding? Tests show a wide range of results. Flexing panels made by the two processes will reveal that the formed part is the more flexible one; some feel that this is due to the absence of molding strains. A heat distortion test gives evidence that the injection molded parts are heavily stressed, whereas the vacuum formed parts are relatively unstressed. It is apparent that with reasonable care in processing, vacuum forming will give better results.

Overheating polystyrene is very detrimental to its impact resistance and certain of its other characteristics, as well as to color. Exponents of the injection molding process will hurry to point out that in plasticizing sheets prior to vacuum forming, many processors accelerate the cycle by increasing the heat intensity and, as a result, seriously damage the plastic material. It should be remembered that a similar situation has existed with injection molding. While scrap material, trimmings, etc., may be re-used nine times through an extruding machine, it can be used only twice through an injection molding machine. This, however, is a most significant point to consider because careless handling of heat intensities in vacuum forming will result in unsatisfactory parts.

Greatest Single Problem

That urge to speed up the cycle and increase profits is, even after 15 years, still the greatest single

problem with injection molded parts for refrigerators. It must be realized that with inner doors, similar disregard for quality results cannot be tolerated. Proper set-up of facilities can eliminate this hazard entirely, but the same could be said of injection molding. Since it is easier to do this in vacuum forming and since it would prove much more fatal, this must be considered as a point against vacuum forming.

A careful study of the problems of weld lines and flow lines is a necessary part of this appraisal. It is established that whether the injection molded panel be single or multigated there will always be flow lines and weld lines, particularly at holes or openings. Weakness around the opening for the latch mechanism and the many mounting holes at the edges as well as those for shelves and the like are a constant threat. Here, too, design must provide an extra factor of safety because of inherent weakness in the process. In the case of the vacuum formed panel, where trimming and piercing follows the molding operation, there is always the possibility that the panel might be pierced while it is either too hot or too cold. Unless this portion of the process is properly set up and is controlled accurately, there is always the danger of cracking around the holes and/or danger of establishing strains in the panel which can be troublesome.

Ease of Cycle Control

In comparing the nature of these problems, it would appear that it would be easier to control the progression cycle of the vacuum forming process to a fixed schedule than to eliminate flow and weld lines in the injection molding process. In this consideration, then, vacuum forming would seem to be the favorite.

Wall sections and compound cross-sections are a problem with either method. The very nature of the vacuum process makes reduction of wall thickness in drawn areas a certainty. Designers have found, however, that it is possible to form shapes which are impossible with injection molding, and this fact more than compensates for weakness due to section reduction. (See sketches 1 and 2, p. 87.) In thick sections for screw mounting and the like, the problem of shrink marks and highly

stressed weakened areas are yet unsolved in injection molding. There are, however, several fasteners available for screw mounting of thin sections that have solved the problem in most cases and are usable with parts produced by either process. Bearing in mind that design must be aimed at the process to be used, there is little to be said in favor of either method when considering cross-sectional areas.

Today many shapes and contours are seen in vacuum formed panels that were not practical with injection molding. Until just recently, vacuum forming was confined to simple shapes but now, for example, door shelf bottoms are formed into refrigerator door panels in a manner impossible to produce by injection molding. In other instances, "H" sections (sketch 3) and even more complicated forms can be produced. Cams, slides, and inserts seem to be more easily and more satisfactorily adaptable to the forming process—certainly, inserts are practical in the formed panel. See sketches 4, 5, and 6.

Thickness Requirements

Another important factor concerns thickness requirements. What is needed today and what for the future? Up until now inner door panels have been made of vitreous enameled steel $\frac{3}{64}$ in. thick; phenolic-paper laminates in thicknesses around $\frac{3}{64}$ in.; and injection molded polystyrene in thicknesses around 0.120 inch. Doors have become larger in the past few years; more and more shelves and the like are being hung on them. Can the doors become much larger? Can much more be hung on them? What size and thickness will be required for the inner door panel of 1960? What of the materials themselves? Will the raw materials be so improved that a $\frac{1}{16}$ in. thick panel will do the work of today's $\frac{3}{64}$ in. thick panel; will the moldability of the material be improved so that simpler, lighter machines will injection mold thinner sections; and/or will new injection molding equipment handle present materials in these sizes and thicknesses?

These and many other questions must be answered before any final conclusion can be reached. At the present time it appears that polystyrene panels in thicknesses less

than $\frac{3}{32}$ in. are satisfactory for inner door panels up to 1500 sq. in. in area. It does not seem likely that panels greater than 3 by 6 ft. by 0.125-in. thickness will be required in quantities.

Today it is not considered practical to injection mold a panel of 1200 sq. in. in much less than $\frac{3}{32}$-in. average thickness. A more average figure would be around 0.100 to 0.110 inch. In the case of vacuum forming, the requirements of thicknesses in the drawn areas is the major factor in thickness limitation; however, it is not impossible to conceive a panel made from material as thin as $\frac{1}{64}$ inch. Therefore, if a large panel is wanted in much less than $\frac{3}{32}$-in. thickness, it must be vacuum formed.

While many people feel that present finishes on extruded sheets are satisfactory, it must be admitted that a really smooth high-gloss surface is not yet a reality. Appearance is one of the major factors in the acceptance of a product, and until an unlaminated highly polished surface can be developed on extruded sheet, the forming process will have limited acceptance for refrigerator inner door panels. Better and better finishes are being developed, and there is every reason to believe that this objection to forming will be eliminated.

Cost

Now to the highly controversial but all important factor of cost. From any angle, there will always be qualifications that will favor one process against the other; by selecting certain standards of performance or quality, consideration of one method can be eliminated—and vice versa. From a cost standpoint, however, some interesting conclusions can be drawn.

One of the most important factors of cost in an inner door panel is tool amortization. The number of cavities required is, of course, determined by the production rate per cavity. Since no insurmountable problems seem evident here, it can be assumed that the vacuum forming process, because of piercing and trimming, will be so arranged that there is no "lost time" in the operation. This means that forming and trimming will be tied directly to the extruder so that the capacity of the extruder will be the limiting factor in the automation set-up, or that the sheet is preheated before it is placed into the vacuum forming machine. Then forming and cooling will be the only bottleneck. In either case there is every reason to believe that production rate should exceed 40 cycles/hr., which is at least the equivalent of injection molding. And the tooling cost for vacuum forming will be approximately 40% of that for injection molding.

Furthermore, the equipment can be had for one fourth as much. Differences in set-up time, machine and tool maintenance, machine operating costs, and depreciation leave no question but that the forming process is the lower cost method by a wide margin.

The following conclusions may therefore be drawn:

1) Both processes can produce mechanically adequate inner door panels.

2) Injection molded panels have decidedly better appearance.

3) Vacuum forming offers decided cost advantages.—END

Hoover Leads

(*From pp.* 93-95)

Nozzles molded from vinyl retain their new look far longer than do those molded of rubber.

Other Plastics

Either cellulose acetate or cellulose acetate butyrate are used for the floor brush backs. The brush tufts are set in the back at an angle so that the brush extends beyond the nozzle. Because of this construction, it is necessary to drill the holes in the brush back since all the holes are at different angles and, therefore, cannot be molded in.

Polyethylene is used for the dusting brush back because it is especially adaptable to a special type of dual purpose molding. By varying the wall thickness of the piece, the heavy outer ring of the back can be molded with sufficient rigidity and body to hold the brush tufts in place while the thinner inner shroud is sufficiently flexible to give without marring fine furniture finishes, yet is firm enough to withstand the suction force of the cleaner.

Cellulose acetate butyrate is used for the carrying handle and the furniture nozzle because of its toughness and resistance to warping.

The aluminum telescoping extension tubes incorporate three plastic components. The same extruded vinyl spring latch cover and molded vinyl gasket which are used on the hose end are again used in the extension tubes. In addition, a tiny molded high-impact styrene guide is inserted between the inner and outer tubes to prevent them from turning with respect to each other. High-impact styrene was chosen for the application because it is tough enough to withstand the riveting operation used for assembly and to resist breakdown of the edges.

Only two small thermosetting moldings go into the Constellation. Partially mineral-filled phenolic is used for the two carbon motor brush insulators, which require heat resistance and dimensional stability.

A small molded nylon bushing placed around the attachment cord where it passes through the housing shell completes the list of plastics parts that make the Constellation such a practical, economical, and highly attractive unit.—End

Treating

(*From pp.* 105-108)

it is the only method other than electron bombardment which can convey energy of sufficient intensity to excite hydrogen atoms to leave the polyethylene molecule, and to do so without the production of a large volume of heat which will raise the body of the polyethylene to its critical temperature. As mentioned before, since surrounding air is excluded by the flame contact, no significant oxidation takes place to "age" the material. The flame contact method is adaptable to all forms of polyethylene such as film, wire, toys, housewares, and bottles. A typical bottle treating setup, shown in Fig. 6, automatically treats at speeds of 5000 or more bottles per hour. A setup for treating flat injection molded articles at similar rates is shown in Fig. 7. An injection molded measuring cup with handle is treated on the sides adjacent to the handle, as shown in Fig. 8. Although the cup is round, it is not rotated in passing the treating heads since only the sides, which alone will be imprinted, require treatment.

Normally, an installation of treating equipment is made after considering all the variations in shapes, since conformity to surface contours is required of the treating heads.

Selecting a Process

In selecting a process for the treatment of polyethylene, careful consideration should be given to all the factors involved in order that desired results be obtained. These factors include: a) required level of ink adhesion; b) speed of ink set-up desired; c) heat sealability level required; d) ink selection and printing method; e) speed of operation; f) type of polyethylene used (primarily molecular weight); g) space available for equipment; h) flexibility of speed range; i) expense of equipment; j) uniformity of polyethylene body; k) controllability of performance; l) control of "aging" of polyethylene; m) permanency of treatment; n) cost; o) safety.

In view of the technical problems and the fact that the processes are patented, it is advisable to seek experienced advice on selection and application of a process to existing needs.—END

Rigid Plastics

(*From pp.* 119-134)

little at still lower temperatures. Impact strengths of the low acetyl acetates appeared somewhat higher than those of the higher acetyl acetates, although the compounds with the highest plasticizer content showed an opposite trend.

For the different cellulose acetate butyrates studied, only the type and amount of plasticizer were varied. As with the acetates, variations of the five properties under investigation were normal with decreasing temperatures. Elongation and impact strength varied most with variations in plasticizer content. Of the different plasticizers selected, the sebacic acid ester gave the best values at room temperature, whereas the phosphoric acid ester showed a slight advantage at lower temperatures. As in the case of cellulose acetate, there was a very pronounced drop in elongation and impact strength from 77 to 10° F. The other properties showed a more gradual change with temperature. Work to produce failure varied somewhat erratically and no definite trend could be established. Throughout, these values were higher than for most other plastics.

Five different ethyl cellulose formulations were tested. As in the case of the other cellulosic plastics, the general trend of property variations with temperature was normal. The influence of type and amount of plasticizer was quite pronounced at 77° F., but with a decrease in temperature, differences in properties between the different formulations became less pronounced.

Since cellulose nitrate plastics during recent years have almost disappeared from the market, only one general-purpose material, with a medium amount of camphor as plasticizing agent, was included in this investigation. The general behavior was similar to that of other cellulosics. A more gradual decrease in elongation with decreasing temperatures was the only outstanding characteristic noted.

Styrene Plastics—Polystyrene is usually employed without the addition of plasticizers. However, variations in properties, especially in elongation and impact strength, can be obtained by copolymerizing styrene with acrylonitrile, by physically mixing polystyrene with acrylonitrile or butadiene polymers, or by doing both. In this investigation one unmodified polystyrene, two copolymers, and two mixtures were tested; the results of the study conducted on these samples are shown in Fig. 7, p. 134.

Moduli showed a normal increase with decreasing temperatures and were, with the exception of those for the mixtures, high for thermoplastics. Elongations and impact strengths were low for the unmodified polymer and the two copolymers, and significantly, were not influenced by a lowering of the temperature. The two mixtures that had rubber compositions acting as internal plasticizers had higher elongation and impact values and showed a normal decrease with decreasing temperatures. Correspondingly, work to produce failure was low and showed no significant change with temperature for the unmodified polymer and the copolymers. The two mixtures had higher values for work to produce failure, and this property showed a normal decrease as the temperature was lowered.

Tensile strength at room temperature varied greatly among the different formulations, the unmodified polystyrene being the strongest. As the temperature was lowered, tensile strength increased much less for the unmodified polystyrene than for the copolymers and mixtures, and the temperature values that were observed at −40 and −65° F. were nearly equal.

The fact that most of the mechanical properties of polystyrene and its copolymers showed little or no change with decreasing temperatures is unique and makes these two classes of plastics different from almost all other thermoplastic materials tested.

Polymethyl Methacrylate—Of the two polymethyl methacrylate materials tested, one was produced by molding and the other by casting. The mechanical properties of the two were almost identical (Fig. 7, p. 134) and the variations of these properties with a lowering of temperature were essentially normal. As in the case of polystyrene, impact strength was low and did not change with a decrease in temperature.—END

THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Plastics at the Chicago Packaging Show

PACKAGING without plastics today would be like a house without windows. It would be cold, bleak, and stodgy, rather than bright, glamourous, and radiant with sales appeal. At almost every turn at the recent Packaging Show in Chicago, emphasis was found on this significance of plastics to packaging.

An example of the expanding use of plastics in just one field of packaging was pointed out by T. W. Sharp, manager of the Flexible Packaging Materials Div. of Bakelite Co., who stated that sales of film for flexible packaging had increased two and a half times from 1946 to 1953, reaching a total of $246 million in 1953—a figure that represents about 390 million lb. of film. He also stated that the 75% increase in grocery store sales during the seven years ending in 1953, attributed largely to self service, visual packaging, and economic factors such as population growth, has led other stores to adopt self service methods where plastics are a major contributing factor.

The most visible influences of plastics at the show were in the application of polyethylene and acetate and in the uses of vacuum formed film and sheet. All were prominent in 1954, but they were even more so in 1955.

Blister and skin packaging, whereby a transparent plastic film is made to protect and cover a given product and at the same time attach it firmly to a cardboard or other base was an outstanding feature of the 1955 exposition. The list of products going to market in this fashion is already far too long for individual mention, but the possibilities are still beyond comprehension. Such packages are pilferproof, give the customer a good look at his purchase before buying, and offer the product in such a neat, trim manner that sales resistance rapidly disappears.

These skin and blister packages are a direct result of the vacuum forming process and add immeasurably to its potential volume. But probably the greatest boon to vacuum forming were the demonstrations at the show of continuous forming from rolls of film up to 30 mils thick. This process is so much faster than the hand-fed sheet-by-sheet process that there is no telling how much it will improve the market for plastics film. In the meantime, single sheet-fed plastics materials continue to march through vacuum forming machines in an ever-increasing quantity. Vinyl—both rigid and elastomeric—impact styrene, acetate, and butyrate are all in the parade, and are being formed into ice cream containers, segmented boxes, trays, counter racks, and counter displays, to mention only a few present applications. Makers of vacuum machinery claim that even thin polyethylene film can be satisfactorily formed on their equipment.

Polyethylene probably received more publicity and was more talked about than anything else at the Packaging Exhibition. Its use has spread even more rapidly than expected from grocery stores to other forms of retail packaging and it has inspired many new packaging concepts for promoting sales. Thus the small 2¼-in. "schoolboy apples" which were once usable only for export are now packaged in 4-lb. bags; youngsters and housewives rush to purchase them because their small size recommends them for economical between-meal snacks. And pipe smokers who willingly accept packages of tobacco that are not protected by polyethylene are becoming rare indeed. Other uses for foil, cardboard, or other materials coated with polyethylene, such as are used in tobacco pouches, have finally caught hold and are running strong. A good example is the polyethylene-coated cardboard ice cream container.

Spouts and spigots for metal drums are being made in ever increasing quantities from polyethylene. Even though not acceptable for use with petroleum products, this application could add thousands of pounds of polyethylene to molders' production if it takes over a good portion of the remaining metal drum market.

Another group of items that caught molders' attention were molded containers for candies and toys, made in the form of boats, animals, etc., that will float in water. They are assembled without adhesives or rivets—the parts are simply snapped together.

Polyethylene bottles are still in the growing stage, with producers complaining that volume has not increased as much as expected. Material cost, low heat resistance, and the tendency for some packaged materials to seep through the walls of containers still continue to be major handicaps.

There was evidence at the show that these may soon be overcome. Bakelite, for example, continues to tell the trade that polyethylene prices will be reduced, but they set no date. Another trend is exemplified by a thin-wall, 4½-oz. bottle for disposable items that is reportedly competitive cost-wise with glass. Rigidity and heat resistance will doubtless be vastly improved in the new low-pressure polyethylenes. The tendency for oils and other substances to seep through polyethylene will probably be overcome by coatings in the not too distant future.

Nylon and melamine are both under consideration for plastic bottles (including aerosol containers), and vinyl, butyrate, and low molecular weight polyethylene are all being tried as coatings for glass aerosol containers.

The impact of polyethylene collapsible tubes couldn't have been more forcibly demonstrated than by the aggressive sales campaigns of competitive metal tube producers.

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First, of course, you consider the results you want. Then you apply the coating that will give you that result. It is important, however, to pay careful attention to application technique. For example, lacquers are used for the striking back painting method which gives depth and gem-like appearance to escutcheons. But to be just right, the molded part should be checked for residual stress and the effect of lacquer solvent on crazing. There must be enough solvent attack to insure lasting adhesion but not enough to weaken the molding. It is important to know whether lubricants are used in the material or molding process and what effect they may have on surface adhesion. Surface treatment and application techniques can be worked out to meet specific needs. For instance, metallizing can be accomplished in any one of five different ways to provide additional physical properties or improved appearance.

An example of metallizing of Styron.

For a specialized interior finish to resemble suede, felt or mohair, a flocking process may be used. Metallizing, flocking and lacquering require many of the same basic considerations when it comes to proper application techniques. Printing and labeling to add printed words, identification, directions, etc., also pose application problems similar to lacquering, although not as critical in nature. Of course, every different type of application technique, coating, or finish requires special attention to its own problems.

How Dow's Plastiatrics Studies Can Help You

Dow studies can be of service to you because they include extensive information not only on different types of coatings and finishes but on proper application techniques, surface cleaners, drying procedures and other data. This information can help you produce results while avoiding a long trial-and-error approach that often means a costly expenditure in both time and money.

Free Bulletin Offered

For more complete information on this subject, send for your free copy of Dow's Technical Service bulletin entitled "Coatings and Finishes for Styron." Write to Plastics Sales Department PL 455R, THE DOW CHEMICAL COMPANY, Midland, Michigan.

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Particularly applicable for packaging in polyethylene tubes are such sticky substances as honey and jam.

Cellulose acetate film and sheet has never taken a back seat at any packaging show. Its use in skin and blister packaging for visual display and protection is rapidly becoming universal. Another type of package with visual display features is a container for apples which consists of a strong cardboard shipping box so constructed that areas of the cardboard can be stripped off, exposing acetate film windows through which the apples can be seen when the container is placed on display. Still another is a cardboard-acetate window box for bananas. It eliminates the trouble of cutting from a stalk and is claimed to add two days' life to bananas on display.

Well-dressed mushrooms now go to market almost exclusively under acetate windows; the material will breathe, yet protect the contents. Lettuce, a stubborn rebel against any kind of packaging, is now being sacked in both acetate and polyethylene at the store level. And a new lettuce crate is now available that is impervious to water from melting ice and to the dampness of refrigerator cars. It is wood veneer over kraft paper with a polyvinyl acetate adhesive.

Acetate in all sorts of laminates, especially with cardboard, is the basis of a growing business. One of the latest forms is a laminate in which apertures are cut in the cardboard, but the film is continuous, thus leaving attractive windows. This window business for acetate is getting big—it's been around a long time, but more and more packages are using it and with much larger windows than formerly.

Saran now appears to be ready to make its big splash in packaging after several years of hesitation. Perhaps part of the impetus comes from its sensational volume of sales as household wrapping, but there is more indication that the main push is coming from the development of machines which handle the film more satisfactorily. Pioneer in this field is the Cartridge Pak developed especially to seal saran film liverwurst containers. It has spread from that to such products as fudge, potato salad, mush, and Bar-B-Q beef. A luncheon loaf, with an electronically sealed saran wrap ½ mil thick, can now be packaged at a rate of 60 per minute. For packages that can be line sealed, the Cartridge Pak and saran film look most promising.

A development program for packaging nuts in saran bags has been going on for years, and now that the idea of taking the air out of the pack and replacing it with nitrogen has been adopted, the secret of success seems to have been found. Nuts can be kept fresh for many months by this method.

The biggest advance in commercial packaging, however, has been in the candy field, where saran eliminates sticking of the candy to the package in the summer time. One candy producer claims he made a 15% sales increase by changing from another film to saran last summer.

Close kin to straight saran is the modified saran Cry-O-Vac, notable for its shrink-tight wrapping property which prevents oxygen transmission. When certain meats such as poultry or wieners are wrapped in it, they can be cooked without removing the film. Two plants are now producing this material and a third is contemplated.

Mylar film was on display at the show in the form of bags for clothes pins, paper cups, and cordial bottles; as a window for a child's toy playhouse; in a macaroni package; and as a laminate with a metallized surface for decorative purposes. It is obviously intended for applications that need strength and clarity and can pay the price. Mylar is a tempting bait for all packaging people. Whether they can use it in big volume is still the big question.

Thin, extruded vinyl film for textiles and paper products was much in evidence at the show and vinyl collapsible tubes were also present; but there was no particular change since 1954, except increased volume. Cast vinyl film also is beginning to loom as a possibility in more applications.

Laminated films of many types were beginning to show up more prominently at this year's show—they could be the big sensation of next year's exhibit.

A New Cellulosic

A NEW development in cellulosic plastics, which the developer—Hercules Powder Co., Inc.—asserts is one of the most significant advances in this field during the past 15 years, is Hercocel W.

Basically, Hercocel W is a cellulose acetate; however, it bears little resemblance in key properties and performance to the conventional product. In addition to having the integral advantages of cellulosics such as gloss, wide color range, and ease of molding, the new material offers a combination of toughness, dimensional stability, and high surface hardness which makes it a logical candidate for such critical applications as cutlery handles, pen and pencil barrels, tool handles, radio cabinets, camera housings, flashlight casings, knobs, vials, and machine keys.

Cutlery having Hercocel W handles has been in test use in one cafeteria for several months without warpage, breakage, or loss of surface finish. During this field trial, the cutlery was subjected to automatic washing, involving water spray temperatures as high as 190° F. Accelerated tests on Hercocel W cutlery handles, ranging from continuous immersion in 190° F. water for one month to boiling water immersion for one hour, produced no distortion of the plastic or pulling away of the plastic from the metal tangs.

In fountain pen barrels, the material has been in use for nearly a year. Besides having good dimensional stability and toughness, these barrels show good surface durability and have suffered no loss of finish through handling.

Various types of housings, such as portable radio cases and water reservoirs, have shown ability to resist breakage under abnormal abuse.

Good dimensional stability of Hercocel W results from the high heat distortion temperature, low moisture absorption, and low volatile loss on heating. Toughness is suggested by its relatively high elongation, stiffness, and surface hardness. The heat distortion temperature is 225° F;

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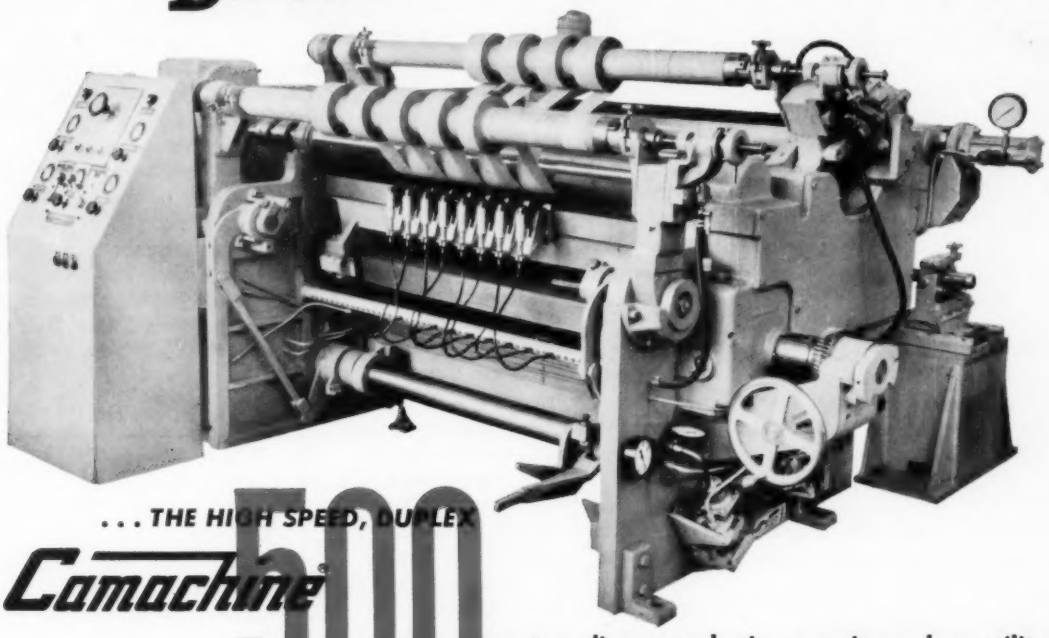

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deformation temperature under load is 185° F.

Hercocel W has both a higher and much sharper melting point than other cellulosics. Above the melting point, the material becomes quite fluid and affords excellent flow into mold cavities. Conversely, Hercocel W sets rapidly in the mold, making fast mold-filling essential for tough, strain-free moldings. These characteristics make Hercocel W suitable for fast, automatic moldings.

Unlike other cellulosics, the new material is not supplied over a flow temperature range, but rather is manufactured to a fixed composition. The price of Hercocel W is 54¢ a lb. in quantities of 20,000 lb. or more, regardless of color. Property charts may be obtained from the company, located in Wilmington, Del.

Koppers' Polyethylene

FIRST producer in the United States to announce production of polyethylene by the Ziegler process is Koppers Co., Inc., Pittsburgh 19, Pa. Industry has long been waiting for an announcement of this kind. It is well known that at least nine firms in the United States have obtained a license to produce polyethylene by this so-called low-pressure method, but exact plans are not known.

Many, many claims have been made as to what may be expected; but even in Germany, where the Hoechst concern has actually gone into production, development work is still under way. Material available in this country is still being produced in laboratories or pilot plants. Koppers asserts, however, that results obtained in processors' plants from experimental materials are satisfactory and that their initial commercial operation for producing Ziegler polyethylene will be underway in the not too distant future. A definite date has not been set. On the other hand, the Koppers plant for turning out conventional high-pressure polyethylene will come into production some time this fall.

The two outstanding properties that make the Ziegler polyethylene different from conventional polyethylene are greater rigidity and higher heat resistance. It isn't difficult to understand why milk bottle makers and housewares molders are especially interested in these properties.

Most companies prefer not to mention the words low pressure. Koppers call their material high modulus polyethylene. Translated into every-day terms, this means a stiffer, more rigid polyethylene. As demonstrated by Koppers, for example, where a piece of ordinary polyethylene pipe would deflect about 6 in. under pressure, pipe made of Super Dylan polyethylene will deflect only 2 in. under the same load. In the property charts, stiffness modulus of Super Dylan polyethylene is listed at 50,000 to 100,000; conventional polyethylene is about 19,000. In addition, Super Dylan pipe has an anticipated burst strength of over 900 p.s.i., which is several hundred pounds over that of ordinary polyethylene.

Perhaps the most sensational display at the Koppers exhibit which was recently arranged to introduce the material was the resistance-to-heat test. Two measuring cups, one ordinary polyethylene, the other Super Dylan polyethylene, were immersed in a pressure cooker and the temperature was raised to 250° F. The Koppers' cup came out in perfect shape—the other was misshapen. A polyethylene that will resist that much heat will certainly broaden the market for this already versatile plastic. Furthermore, the new polyethylene will resist low temperatures even better than most other plastics —its toughness at −80° C. is assured.

Koppers also claim that despite their material's toughness, rigidity, and high heat resistance, it will mold well within the normal range of molding temperatures. It requires about 50° F. more heat than ordinary polytheylene and 30 to 50° F. less than many of the rubber-modified polystyrenes. Its finish will be smooth and glossy. In thin sections, such as film, it is transparent—the natural color in greater thicknesses is a translucent milk white. Color range will be broad in both translucent and opaque, depending on the thickness of the end-product.

Another interesting assertion is that the diffusion through Super Dylan bottles is about one third that of ordinary polyethylene.

Officials also assert that films produced from this material are strong, lightweight, and can be made in thicknesses to feed through automatic machines.

Some of the more unusual items suggested for production from this material are radio housings, steering wheels, washing machine agitators, refrigerator parts, and battery cases.

Some additional property comparisons between Super Dylan and regular polyethylene are:

Property	*Super Dylan*	*Regular*
Specific gravity	0.93-0.95	0.92
Tensile strength, p.s.i.	2800-5500	1500-1800
Elongation in tension or stretch, %	400-100	550-50
Mold shrinkage, in./in.	0.012-0.025	0.02-0.05

Electrical properties of Super Dylan and regular polyethylene are comparable.

U.S.I. Isosebacic Acid

MORE than 125 companies have received evaluation samples of Isosebacic acid, a new synthetic organic chemical developed by the Research Dept. of U. S. Industrial Chemicals Co., Div. of National Distillers Corp., 99 Park Ave., New York 16, N. Y.

The product is the result of more than three years' research and for the past 15 months has been the object of intensive pilot plant development. U.S.I. Isosebacic acid is a mixture of isomers of sebacic acid in the following approximate proportions: 2-ethyl suberic acid, 72 to 80%; 2-2' diethyl adipic acid, 12 to 18%; and sebacic acid, 6 to 10 percent.

The company states that the product shows considerable promise as a raw material for the production of vinyl resin plasticizers with excellent low-volatility, non-migration, and low-temperature characteristics. Other promising applications include: the production of polyamides (nylon type); use in alkyd resin manufacture to impart flexibility and water resistance to the surface coating film; the synthesis of ester lubricants of the type used in jet pro-

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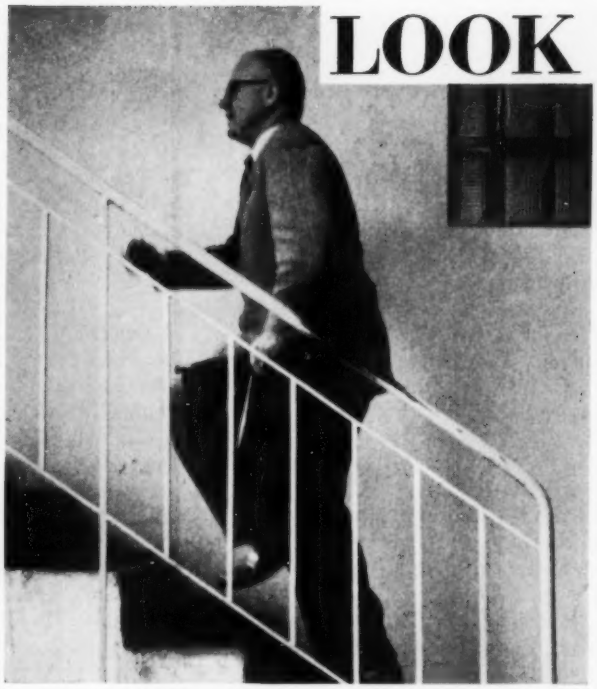


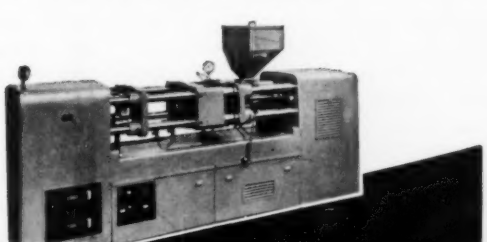
* LOOK Magazine photo

LOOK told in its January 25 issue under the heading "What's behind the German comeback?" about Carl Gisbert Siebel, a maker of injection molding machines and molds for plastics:

"Carl Gisbert Siebel is a hustling industrialist whose swift success mirrors the rags-to-riches story of postwar Germany. His own relentless drive is one force in the cumulative effort of millions of Germans . . . Germany mounted the heights on the back of $3 billion of U.S. aid . . . Good labor relations helped. Yet, none of these things would have produced the astonishing results without Germany's secret weapon: a passion for hard work and discipline unmatched in Europe. This weapon of diligence is the big reason for Germany's 500 per cent increase in industrial production in the last eight years."

And now let Siebel speak for himself:

America helped us — give us a chance to help you. Our injection molding machines can do it. Each one is an individually powered, independent unit; it can be put to work anywhere at a moment's notice, with no need of special foundations or accumulators. Completely hydraulic, oil-operated, it is absolutely dependable whether running semi or fully automatic. Drop me a line, and let me send you by return mail full details of what our injection molding machines from $1^1/_2$ to 12 ounces can do for your plant.



DR. ING. SOMMER

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F. SOMMER

LUEDENSCHEID, WESTERN GERMANY

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pelled aircraft; the production of polyester resins; the synthesis of polyurethane resins for foamed plastics; synthetic rubber; and protective coatings.

The initial selling price of U.S.I. Isosebacic acid, in market development quantities, is 45¢ per pound.

Vinyl Roof

ADDITION of a 28,000-sq. ft. wing to the plant of Plastic Creators, Inc., 16 Industrial Ave., Little Ferry, N. J., fabricators of vinyl film and sheeting, has expanded the total working area of the company to 36,000 feet.

An unusual feature of the new wing is the installation of an electronically sealed 100- by 135-ft. 20-gage vinyl covering for the wooden roof. Attached to the roof with adhesive, the vinyl covering provides both an effective means of waterproofing and a good surface on which out-of-doors work can be done in good weather. Vinyl stripping laid along the edges of the sheet prevents water from seeping under the covering.

The company is also active in the production of swimming pool liners from 12 by 37 ft. in size up to 20 by 40 ft. and aluminized perforated vinyl indoor motion picture screens in sizes up to 30 by 60 feet.

Another unusual vinyl product which the company is marketing is a huge electronically sealed vinyl tarpaulin for use in ball parks in both the minor and major leagues. The largest size which the company has fabricated thus far has been a 25,000-sq. ft. tarpaulin for the Boston Red Sox ball park. The tarpaulins are made of 210 denier nylon laminated between two sheets of vinyl, 0.004 to 0.008 in. thick.

Currently, Plastic Creators are experimenting with electronically sealing vinyl foam and polyurethane foam to vinyl sheeting for place mats, table pads, mattress pads, etc.

Pioneers

THE Plastics Pioneers announce that the following officers have been elected for the 1955-1956 fiscal year: president—C. S. Blount, Bakelite Co., Div. of Union Carbide and Carbon Corp.; vice president—James B. Neal, Norton Laboratories, Inc.; secretary-treasurer—Hans H. Wanders, Northern Industrial Chemical Co.

New directors are: H. Rankow, Watertown Mfg. Co.; Sidney Howell, Mack Molding Co.; C. J. Groos, Boonton Molding Co.

Retiring president of the Pioneers, Alan S. Cole, Breskin Publications Inc., was presented with a silver platter and a commemorative certificate at the annual meeting. In absentia, a watch was presented to Hans Wanders as a gesture of thanks for his untiring efforts as secretary-treasurer of the organization.

Diversification

PLANS for a program of product diversification were outlined by Eugene R. Perry, president of National Vulcanized Fibre Co., Philadelphia 7, Pa., at the company's annual stockholders meeting.

The company expects to enter the consumer field with a line of products made from vulcanized fibre (heretofore, emphasis has been on the industrial market). The company will also bring out a rubber fibre product with new, improved properties; an epoxy resin high-pressure laminate of particular value for printed circuitry; and a new line of nylon products for industry.

Dielectric Film

SHEET material, known as AMF Fiberfilm, which will enable manufacturers of electrical components to design more efficient electrical insulation into their products was introduced by American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y., at the Institute of Radio Engineers Show.

First of a new family of engineering materials, the product is made from glass microfibers and Teflon. Available in both porous and nonporous forms, the films represent the refinement of the first practical method for preparing long continuous lengths or rolls up to 40 in. wide of very thin, high-quality film having all the excellent electrical properties of Teflon, and at the same time highly desirable mechanical properties. Depending on operating conditions, they will perform satisfactorily in the range from 200 to 250° C.; electrically, their dielectric breakdown strength is satisfactory in the range from 1400 to 4000 v./mil. d.-c., depending on the type of film.

Plasticizer for Electricals

COMPLETION of a series of tests for a new plasticizer, Drapex 3.2, as a component of low-temperature electrical insulation has been announced by Argus Chemical Corp., 633 Court St., Brooklyn 1, N. Y.

Drapex 3.2 is an octyl epoxy stearate and is comparable to dioctyl sebacate in most properties. It is recommended for use in all vinyl products which require low-temperature flexibility.

In addition to low-temperature flexibility, Drapex 3.2 provides low volatility and high resistance to extraction by soaps and detergents. Furthermore, its epoxy content helps to improve the heat and light stability of the vinyl compound.

The new plasticizer sells for 40¢ a lb. in bulk, prepaid. Samples and Technical Bulletin No. 4 may be obtained from the company.

Monsanto in Argentina

ANNOUNCEMENT has been made by Monsanto Chemical Co., St. Louis 4, Mo., that formal approval of the Argentine government has been given for the formation of Monsanto Argentina, S.A.I.C., and construction of a plant near Buenos Aires for the manufacture of polystyrene has been started.

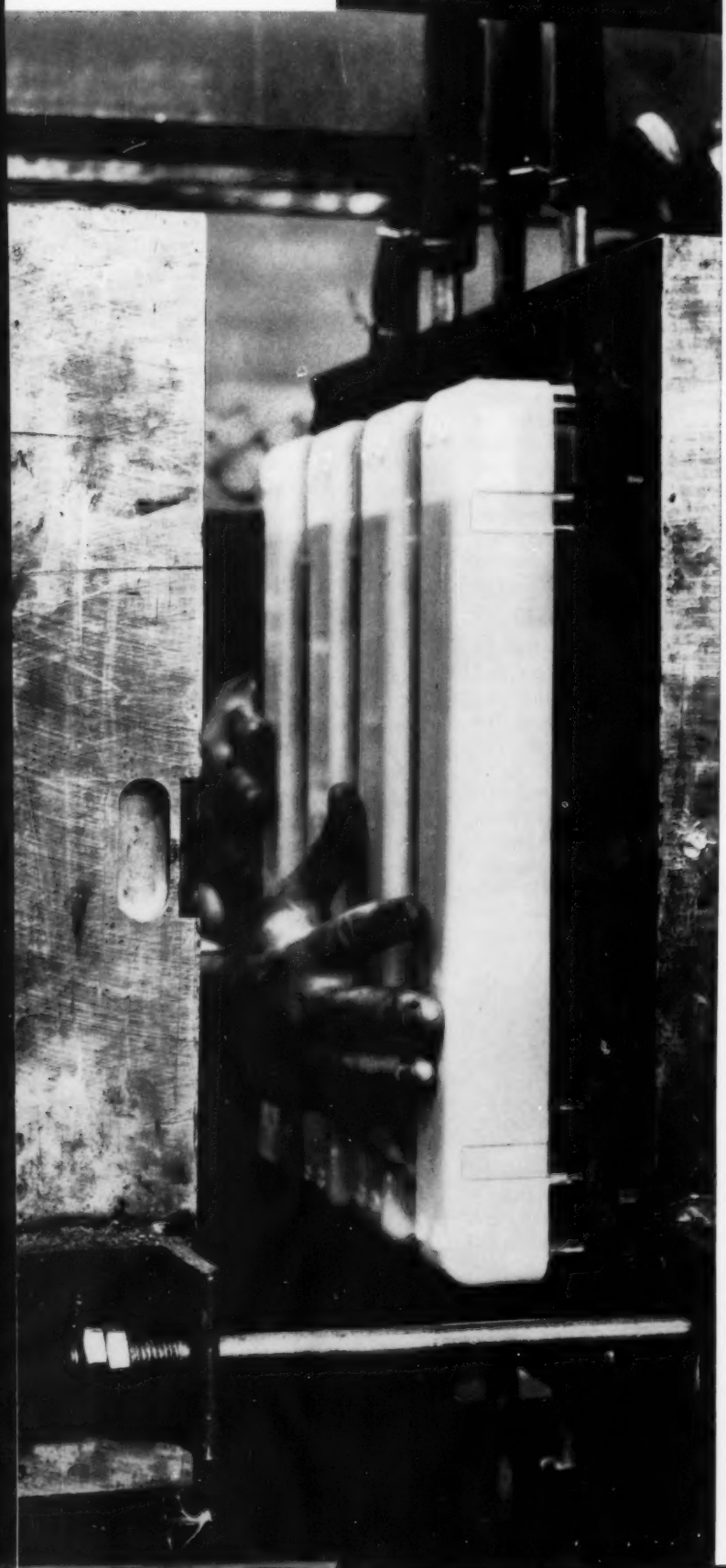
The Argentine company is a wholly-owned subsidiary of Monsanto Overseas, S.A. Design and engineering work has been completed and the plant is expected to be in operation by early 1956.

President of the new company is Stanley D. Allchin and managing director is Enrique E. Krag, both of Buenos Aires.

Cast Film Production Increase

PRODUCTION of Krene vinyl cast film will be more than doubled at Bakelite's new plant in Ottawa, Ill., according to an announcement by C. W. Blount, vice president in charge of sales. Additional new

Monsanto Shots



Lustrex Hi-Flow 55 ups cutlery tray production 50%!

How Monsanto's soft-flow styrene raised output from 59 to more than 90 shots an hour

The schedule called for 8,000 units a day from a 4-cavity pin-point gated mold, according to Oscar Daffron, vice-president and plant manager of Como Plastics, Columbus, Indiana.

"With each shot, including sprue and runner, figuring 16 ounces, we really had to crowd our 16-ounce machine. Even so, the best cycle we reached was 59 shots an hour."

Then Como Plastics tried Lustrex Hi-Flow 55 styrene on the job – and the whole picture changed.

"We upped the cycle and over a month's period averaged well above 90 shots. At the same time, by using Lustrex Hi-Flow 55, we were able to cut the pressure 300 pounds and run the job at 40° less temperature."

Faster cycles at reduced pressures and temperatures are possible on most jobs with Lustrex Hi-Flow 55 styrene because of the outstanding molding characteristics of this soft-flow material. In addition, Lustrex Hi-Flow 55 performs with outstanding efficiency on molds with deep draws and thin walls of uniform thickness.

For proof that Monsanto's soft-flow styrene can speed up cycles and increase production rates, try Lustrex Hi-Flow 55 on your next job. See your Monsanto representative or write Monsanto Chemical Company, Plastics Division, Dept. MP7, Springfield 2, Mass.

Save on your next job... try

HI-FLOW 55
MONSANTO LUSTREX Styrene Plastic

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equipment will make Krene cast film available in larger widths up to 48 inches.

Mr. Blount stated that Krene cast film is an exceptionally clear film. In addition, the toughness of the material protects the product from customer handling and promotes longer shelf life.

Laminated to aluminum foil, paper, cloth, and other films, Krene cast film provides these other packaging materials with an excellent moisture vapor barrier, Mr. Blount continued. Such laminates are a principal use of the cast film in packaging products which tend to pick up moisture, such as drugs and pharmaceuticals, hygroscopic chemicals, photographic film, surgical supplies, and materials that must be sterilized in the package.

Frequently used as a lightweight, flexible insulation for electrical supplies, Krene cast film also makes durable storm windows, waterproof bandages, pressure-sensitive tapes, and protective garment covers.

New Materials by Borden

COMMERCIAL quantities of dibutyl fumarate are now available from The Borden Co.'s Chemical Div., 350 Madison Ave., New York 17, N. Y. The company has also announced that it has begun marketing fumaric acid to the plastics, paint, rubber, food, and textile manufacturers. Both of these chemically active compounds are produced for Borden by Bzura, Inc.

Dibutyl fumarate is reported to be of primary interest to manufacturers and formulators of plastic and related products as a monomer for polymerization and copolymerization. The physical properties of polymers produced with it can be varied from hard brittle resins to soft, internally plasticized, elastic materials.

Copolymers of dibutyl fumarate with vinyl acetate, vinyl chloride, acrylates, and styrene are useful in such applications as surface coatings, free films, permanently tacky adhesives, fibers, synthetic lubricants, and oil additives. Dibutyl fumarate copolymerized with vinyl acetate gives outstanding results in emulsions for water-based paints. It is a considerably more active monomer than dibutyl maleate.

Fumaric acid is an unsaturated dicarboxylic acid, in the form of odorless, fine white granular crystals. It is practically non-toxic and is being used in foods as an acidulant in place of citric acid.

Esters, monohydric alcohols, and fumaric acid will give thermoplastic polymers. Fumaric acid and polyhydric alcohols give thermosetting resins which can be converted to the infusible form and are finding wide use in the field of polyesters. Suitable copolymerization agents will speed up the hardening process. Fumaric acid is useful in upgrading drying oils and in the manufacture of alkyd resins.

Unplasticized Vinyl Sheet

SARDINE cans produced from 6 mil thick rigid vinyl sheet and claimed to be less costly than tin cans are now reported to be on the production line in Germany. The vinyl sheeting is supported by a cardboard tray to give the can additional strength in handling. Product visibility and the ease with which the package can be opened are other advantages. The package is expected to have increased use for other types of fish products and for some forms of vegetables and meat.

The vinyl material used for the cans is known as Genotherm and is a product of Anorgana G.m.b.H. of Gendorf, Germany. It is available in the United States through the company's agent, David S. Greenfield, 1489 Plimpton Ave., New York 52, N. Y.

This transparent, unplasticized, non-toxic polyvinyl chloride sheet is furnished in a variety of sizes and prices. The thinnest material in the line is 0.0012 in. thick, 39.37 in. wide, costs 98¢ a lb., and yields 16,720 sq. in./lb.; the thickest material is 0.012 in. thick, 32 in. wide, sells for 70¢ a lb., and yields 1670 sq. in. per pound. Prices can be quoted in 13 different thicknesses and all prices are F.O.B. Hamburg, Germany. Import duty is still undetermined since no exact classification has been established for this material. Specific gravity of the material is 1.38.

Genotherm may be obtained either in stretched or unstretched form. The stretched version has a 40% shrinkage and is especially useful for wrapping cable since it will shrink tight around the wire. It has a strength of 16,000 p.s.i. in length of the sheet when stretched or oriented and half that strength across the width.

The unstretched sheet or film is more applicable for food packing in those cases where shrinkage is not desirable. It is especially suggested for such products as cooking oil.

Water vapor transmission at 100% humidity is as follows: for 1.6-mil thickness, 0.45 g. per 100 sq. in. for 24 hr.; for 2.4-mil thickness, 0.31 g.; for 4-mil thickness, 0.18 g.; and for 12-mil thickness, 0.078 grams. In other words, the w.v.t. is said to be a little less than that of a laminate of acetate and polyethylene.

Oriented Genotherm is calendered, stretched both ways by thermal treatment, then recalendered. It is claimed that this treatment gives better folding properties to the sheet and that the transparency of the sheet is improved by adding suitable lubricants and stabilizers. The calendered sheets cannot be produced in an absolutely glass-clear quality, but the transparency is good. Sheets which have undergone this thermal after-treatment show a better tensile strength and less permeability as far as flavor and aqueous vapor are concerned than untreated sheets.

This P.V.C. rigid sheeting is stable at temperatures of about 100° C. for many months or even years, and at temperatures of about 80° C. it shows an unlimited stability, according to company literature.

P.V.C. sheeting that has undergone thermal after-treatment may be cut, stamped, punched, embossed, vacuum formed, folded, bonded, welded, laminated, stitched, and printed.

Aluminum Molds for Vacuum Forming

USE of aluminum or iron oxide powder with epoxy resin for the production of vacuum forming molds was recently demonstrated by Metals Disintegrating Co., Inc. at the home office in Elizabeth, N. J.

Company officials claim that although this combination first ob-

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MODERN PLASTICS gets the okay from *engineers and technical personnel with buying authority.* They say it's *the most useful* magazine in the field. For example, a Starch survey made at the National Plastics Exposition showed that MODERN PLASTICS gives these men more help in their work with plastics than all other magazines in the field combined! The figures are:

MODERN PLASTICS	**62.6%**
MAGAZINE B	**22.1%**
MAGAZINE C	**8.2%**
MAGAZINE D	**3.8%**
MAGAZINE E	**4.1%**
MAGAZINE F	**2.6%**

For more information about the survey, the magazine or the market, write:

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tained recognition in the manufacture of sheet metal forming dies, it has more recently won widespread approval as a mold material for the vacuum forming process. The metal-plastic molds are said to be less costly than normal metal dies. When aluminum powder is used, a better polish can be obtained; when iron oxide is used, the metal powder is less than half the cost of aluminum, but the mold has a rusty appearance and is only suggested for certain applications where surface finish is not too important.

A carefully made mold of one part Epon resin 828, two parts aluminum powder, and appropriate catalysts will have a transverse rupture strength of 20,000 p.s.i. and a Barcol hardness of 55 at room temperature.

The metal powder may be obtained direct from Metals Disintegrating Co. and the molder can do his own forming with epoxies or he can obtain mixes of metal powder and Epon resins. Finished molds are available from Kish Resins Co., Lansing, Mich.

Abrasion-Resistant Clear Sheet

MANUFACTURE of thermoplastic Dura-lite in sheets will open up new fields for the use of clear plastics, according to an announcement by The Homalite Corp., 15 Brookside Dr., Wilmington 166, Del.

The company claims Dura-lite to be outstanding for its high abrasion resistance—five times that of ordinary methacrylate. It resists crazing and is immune to most corrosive chemicals. Both formable and machinable, the material will also withstand severe weather conditions.

Because Dura-lite's flexural strength is nearly twice that of methacrylate and its tensile and impact strength has also been improved, it is particularly valuable where difficult bends and forming operations are encountered or where crazing is a problem. The material may also be machined like most metals, drilled, sawed, cemented, and fabricated readily.

Dura-lite has important advantages as a replacement for methacrylate in many applications. Its improved abrasion resistance makes it suitable for all types of glazing, especially in formed instrument panels and dials and television and clock faces. Where applications involve exposure to commonly corrosive chemicals, such as DDT spray, gasoline, or alcohol fumes, the thermoplastic material may be used with safety.

Dura-lite is available in sheets in thicknesses of 1/16, 3/32, 1/8, 3/16, and 1/4 inch. Standard sheets are produced in sizes up to 40 by 50 inches.

Petrochemicals Laboratory

A NEW laboratory devoted to the technical side of the petrochemicals marketing business has been erected at the Esso Research Center, Linden, N.J.

Housing 11 separate laboratories plus office space, the facility will be known as the Enjay Laboratories. It will serve as the scientific arm of Enjay Co., Inc., the Standard Oil Co. (New Jersey) affiliate marketing petrochemicals in the United States, Canada, and parts of Europe.

The 40-member staff of the division will conduct research and technical trouble-shooting on additives for fuels and lubricants, chemical intermediates, and butyl rubber. They will seek new ways in which petrochemicals can be adapted by various manufacturers. The trouble-shooting work involves solution of specific problems encountered by Enjay customers.

Thick Polyethylene

POLYETHYLENE sheeting in various thicknesses up to 0.125 in. is now available from Celanese Corp. of America's Plastics Div., 290 Ferry St., Newark 5, N. J. The company states that many items, including those now made by conventional molding methods, can be produced economically from heavy-gage polyethylene sheeting by vacuum or press-type forming, especially where relatively frequent design modifications or short runs are encountered.

Rolls 44 in. wide in 0.015 and 0.020-in. thickness sell for 59¢ in 5000-lb. lots; rolls from 0.030- to 0.060-in. thickness sell for 80 cents. Sheets 44 by 60 in. vary from 62 to 82¢ a lb. in 5000-lb. lots and over. Sheets 22 by 52 in. sell for $3.11 per sheet in 0.090-in. thickness and $4.30 in 0.125, in 5000 lb. lots or over. Prices quoted are for natural color; special colors are available at slightly higher cost.

Toolinglease Plan

INAUGURATION of a method of financing tools, dies, molds, jigs, and fixtures has been announced by Mechaneers, Inc., Municipal Airport, Bridgeport, Conn. Copyrighted as the "Mechaneers Toolinglease Plan," it allows a manufacturer to save capital investment and avoid long term amortization through long or short term leasing of equipment. The company claims that the plan has obvious tax advantages and reduces risk involved in outright purchase of tools for unproven manufacturing ventures. The plan can be negotiated with or without purchase options.

Mechaneers also announces the installation of new ultra sonic equipment which permits machining, tapping, drilling, and hobbing of carbide and hardened tool steel. The firm states that this is believed to be the only equipment of its kind in any contract tool and die shop in the eastern part of the United States.

Lacquers for Metallizing

TWO new lacquers that provide tough, flexible, and non-flaking top and bottom coats for the metallized surface of polystyrene parts have been developed by Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N. Y. For best results, the company recommends that the lacquers be used as a team for perfect chemical compatibility.

The base coat lacquer, called BC-107, prepares the surface of the plastic for permanent metallic deposition by providing a smooth, glossy finish that fills and covers all cracks. The bottom coat can be force-dried in 1 hr. at 150° F.

The top coat, called TC-101, is a clear, water-white lacquer, specifically formulated for use as a tough protective coat after the metal has been deposited. The lacquer prevents the thin metallic silver or aluminum film from flaking off, protects it from abrasion, and gives it a lustrous finish. The top coat can

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be force-dried at 150° F. in about 30 minutes.

Both BC-107 and TC-101, available in 5-gal. cans and 55-gal. drums, can be applied by dipping or spraying. The manufacturer points out that metallizers need not add any catalyst or thinner because both coatings are supplied ready to use.

Connectors for Tubing

SMALL sizes of polyvinyl chloride fittings and adaptors for connecting polyethylene and other flexible tubing has been developed by S. & C. Mfg. Co., 6245 Wiehe Rd., Cincinnati 13, Ohio. The new fittings are suitable for tubing-to-tubing and tubing-to-pipe connections in ¼ and ⅜ in. size range.

The company reports that the units may be used for many types of flexible liquid and air-tight instrumentation tubing connections in air or fluid actuated devices; for oil or other liquid transmission lines in engines and motors; for connecting direct reading pressure gages to tubing systems; and for laboratory set-ups and industrial transmission of fluids or gases.

No tools are required in using the new components. The adaptors are suitable for connecting ¼- and ⅜-in. tubing to ⅛- and ¼-in. pipe. The unions connect ¼- or ⅜-in. tubing. Large adaptors and unions suitable for ½-in. tubing are also included in the line.

Educational Projects

PLASTICS industry members in England are being solicited for additional funds for their Plastics Industry Education Fund which was established in 1951. Administration of the Fund is handled for the trustees by the British Plastics Institute.

At present, income to the Fund is approximately $14,000 per year; another $14,000 is needed to maintain the purposes for which the Fund was set up, which are to establish scholarships for the promotion of education within the plastics industry; to assist needy students in obtaining their degrees in the science and technology of processes used in the plastics industry; to help students procure publication of monographs; and to aid colleges and universities in the promotion of education within the plastics industry.

Colloid Science

A two-week special summer program in colloid science will be presented from July 11 to July 22 during the 1955 summer session at Massachusetts Institute of Technology. Among other subjects, the course will cover the applications of colloid science in industries dealing with rubber and plastics. The program will be directed by Dr. Ernst A. Hauser, professor of colloid science at M.I.T.

Registrants may reserve rooms in the Institute's dormitories during the program. Full details and application blanks may be obtained from the Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Mass.

Gordon Research Conferences

Announcement has been made by Gordon Research Conferences that its meetings will be held in New England this year from August 1 to August 5. Location of each conference varies, but request for attendance or any additional information should be directed to W. George Parks, director, University of Rhode Island, Kingston, R. I.

Gordon Research Conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting, consisting of scheduled lectures and free discussion groups.

The purpose of the program is not to review the known fields of chemistry, but primarily to bring experts up to date as to the latest developments, analyze the significance of these developments, and to provoke suggestions as to underlying theories and profitable methods of approach for making new progress. In order to protect individual rights and to promote discussion, it is an established rule of each Conference that all information presented is not to be used without specific authorization of the individual making the contribution, whether in formal presentation or in discussion. No publications are prepared as emanating from them.

Plywood Research

The Lawrence Ottinger Forest Products Fellowship Fund has been established at the University of Washington College of Forestry by United States Plywood Corp. to perpetuate the name of the company's founder, Lawrence Ottinger. The perpetual fund will be devoted to creating graduate fellowships in the field of plywood, wood particle board, and adhesive development.

Nearly 25% of the fellowship fund was made up of voluntary contributions by company employees and friends and colleagues of Mr. Ottinger.

Two New Itaconics

AVAILABILITY of two new esters made of itaconic acid—dimethyl itaconate and dibutyl itaconate—has been announced by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y.

A company spokesman states that it is the first time that these highly reactive monomers, which have been found to copolymerize readily with many other monomers, including acrylonitrile, the methacrylates, vinyl chloride, styrene, and butadiene, have been offered to the chemical and allied industries. The new members of Pfizer's series of fermentation-derived industrial chemicals may also be co-polymerized with other vinyl-type monomers to make transparent plastics.

Copolymers of dimethyl itaconate with styrene, or one of the methacrylates, yield clear, water-white materials with excellent optic properties.

Samples of dibutyl itaconate, a clear liquid, and dimethyl itaconate, a white crystalline solid, are being made available for evaluation.

Bakelite Silicones

FOUR new types of silicone molding material with improved properties have been developed by Bakelite Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. It is claimed that unusual heat resistance, ranging up to 660° F., and improved moldability are combined in the new compounds.

The company states that substan-

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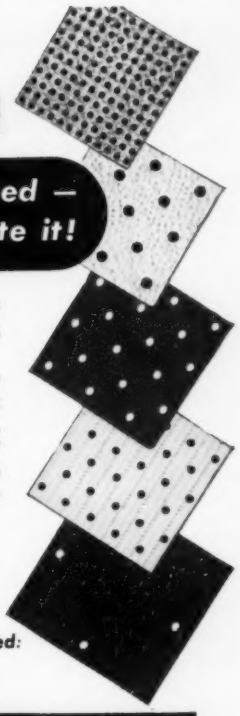

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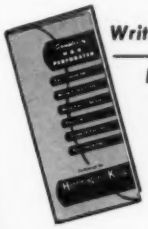

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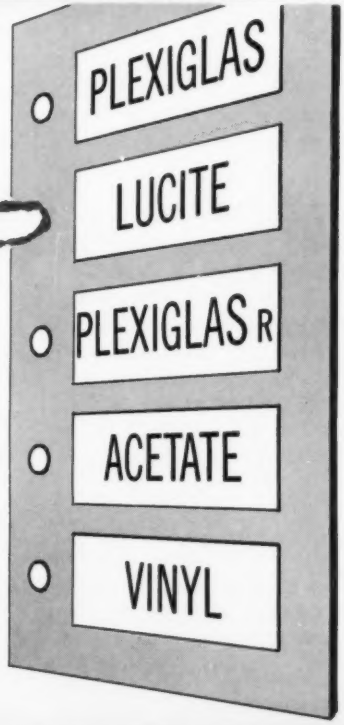

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tial savings in weight and size of electrical equipment are made possible by the use of these silicone compounds, permitting greater latitude in design of electrical components. During continuous operation at 570° F., parts made of Bakelite silicone molding materials retained excellent electrical properties at both low and high frequencies.

The four Bakelite silicone molding materials are designated as GMGA-5001 Natural, GMGA-5002, GMGA-5003, and GMKA-5004. GMGA-5003 and GMKA-5004 are glass-filled, compounds designed for greater impact resistance coupled with good electrical properties. GMGA-5001 and GMGA-5002 are general-purpose, mineral-filled compounds. Conventional heat and pressure curing conditions without after-baking of molded parts are recommended for these silicone molding compounds.

Curing Agent for Epoxies

DEVELOPMENT of a new liquid curing agent, Epon Curing Agent Z, for use with epoxy resins has been announced by Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y.

Curing Agent Z is expected to replace solid polyamine curing agents for epoxy resins in many applications requiring optimum chemical resistance or improved physical and electrical properties at elevated temperatures. It is a liquid of approximately 2000-cp. viscosity which can be easily mixed with Epon 828 at room temperature, simplifies handling, and eliminates "heating-in" required with solid curing agents.

Milled Fibrous Glass

ADDITION of milled fibrous glass to its line of reinforcing materials for molded and laminated plastics has been announced by Ferro Corp.'s Fiber Glass Div., 200 Woodycrest Ave., Nashville, Tenn.

The milled fibers are made from 14,000 yd./lb. continuous strands and are furnished in four screen sizes, ranging from 1/32 to 1/4 in. maximum length. In addition to providing a high degree of impact strength in reinforced plastics products, the fibers can also be used to prevent crazing in casting and potting resins. Other uses are in controlling the viscosity of liquid resins and in improving the dielectric properties of plastic products.

New Dinnerware Molder

ENTRANCE of Chicago Molded Products Corp., 1020 N. Kolmar Ave., Chicago 51, Ill., into the melamine dinnerware field with a line especially designed for commercial and institutional use has been announced.

Named Cloverlane, the new line has been designed by Jean O. Reinecke, Society of Industrial Designers. Chicago Molded states that the design features incorporated in Cloverlane, including the elimination of sharp corners and edges and improved drainage and aeration features, will make this dinnerware particularly adaptable to modern dishwashing. These innovations, coupled with the impact strength of melamine, make Cloverlane highly satisfactory for use in restaurants, hotels, hospitals, and other institutions.

Thiokol Plasticizers

BECAUSE of increased demand for low-temperature plasticizers, Thiokol Chemical Corp., Trenton 7, N. J., has expanded its facilities for the production of plasticizers TP-90B and TP-95.

The new plasticizers are used for low-temperature plasticization of GR-S, neoprene, acrylonitrile-type rubbers, natural rubber, and vinyl resins. They are claimed to maintain high resilience over a wide temperature range, are compatible with the elastomers, and do not appreciably impair their physical properties even at high concentrations.

Sponge Vinyl Plastisol

INTRODUCTION of a new series of sponge vinyl plastisols has been made by Watson-Standard Co., 218 Galveston Ave., Pittsburgh 12, Pa. The plastisols contain chemical blowing agents and are shipped as pourable liquids. When subjected to heat from 300 to 400° F. for 3 to 30 min., the compounds produce a uniform vinyl sponge. Temperature and time required for fusion depend on size and mass of the object and the cross-section of the sponge. The company states that the expansion rate can be controlled by the compounder to provide plastisols which will expand 100 to 600% and provide densities from 8 to 30 lb./cu. foot.

The new compounds may be spread-coated, sprayed, molded, dipped, or cast. When used in combination with vinyl plastisol skins, the fabricator may produce in a single operation many items, which with previous methods required fabrication from several integral parts.

Dacron for Reinforcement

MANUFACTURE of new Dacron blankets in various thicknesses for plastic reinforcement has been announced by Troy Blanket Mills, 200 Madison Ave., New York 16, N. Y. The blankets can be used with polyesters, epoxies, or other plastics resins.

General-Purpose Epoxy

DESIGNATED Stycast 2651, a low-cost, general-purpose epoxy casting resin has been developed by Emerson & Cuming, Inc., 869 Washington St., Canton, Mass. Supplied as a free flowing liquid, Stycast 2651 can easily be poured into even small cavities. Cure can be effected at room temperature.

The cured material is stable over a temperature range from —100 to 400° F. Low thermal expansion permits embedment of large inserts. Adhesion to plastics, metals, and ceramics is claimed to be excellent.

Applications of Stycast 2651 include encapsulation of rotors and stators, embedment of electronic circuits, as well as dip coating of components.

Red for Polyethylene

NEW method of producing cadmium pigments developed at the plant of Ferro Corp., 4150 E. 56th St., Cleveland 5, Ohio, has made it possible for the company to market a new standard red (PSP 70) at what is said to be a new low price of $2.75 per 100 pounds. Company literature states that it is an inorganic pigment which will not burn out or bleed, has excellent light stability,

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and may be used for polystyrene as well as polyethylene. The pigment is especially suited for dry coloring.

As part of their over-all service for supplying colors for polyethylene, Ferro has concentrated on making a wide range of pigments that can be used for either the light pastel translucent colors or the darker shades. The firm asserts that at percentages of 0.1%, Ferro pigments produce a color that is more transparent than colorless polyethylene. Ferro also advises that the use of dry color allows the manufacturer to stock a minimum quantity of polyethylene since the material can be colored as needed, reducing to a minimum the amount of obsolete colored polyethylene in inventory.

The only equipment necessary for coloring polyethylene is a drum roll which can be purchased or built.

R.C.A. Plasticizer

GLYCOL ester with superior low-temperature behavior and improved resistance to extraction has been developed by Rubber Corp. of America, 274 Ten Eyck St., Brooklyn 6, N. Y. Designated as BD-8 (butanediol dicaprylate), the compatibility of the plasticizer, according to the manufacturer, is excellent.

Consulting Chemists

FIFTEENTH edition of Consulting Services has been published by the Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y. The book is divided into three sections. Section I, the Classifier, helps the reader determine what specialties the consultants handle; Section II, Scope Pages, describes each member's qualifications; and Section III, the Index, gives each consultant's geographical location.

Plastisol for Plating Racks

LOW-COST, general-purpose plastisol for coating plating racks has been developed by Stanley Chemical Co., a Div. of The Stanley Works, New Britain, Conn. Designated as #77X-1921, the material is said to cut costs for users, as well as for makers of plating racks, baskets, and similar materials handling equipment. It is used with either of two Stanley primers—#40X-415 or #72X-426A.

The plastisol, produced in green, has a low-viscosity factor and rapid drain-off characteristics which minimize carry-over and waste. For use with degreasing solvents containing trichloroethylene or perchloroethylene, the company continues to recommend its #77X-1078.

EXPANSION

Celanese Corp. of America's Chemical Div. announces that production capacity of the new vinyl acetate unit of its plant in Pampa, Texas, has been doubled. **R. W. KixMiller,** general manager of the division, states that the current expansion is considerably ahead of the anticipated schedule.

There is a potential 80 million-lb. consumption of vinyl acetate in water-based paints by 1957, in addition to uses in adhesives, pharmaceuticals, coatings for leather, paper and cloth, sheets and films, according to Mr. KixMiller.

Woodall Industries, Inc., 7565 E. McNichols Rd., Detroit 34, Mich., has started construction of a new building in Franklin, Ohio, comprising an area of about 60,000 sq. ft. on a 12-acre site. It is estimated that the total investment in plant equipment and inventory will be approximately $750,000. When operating at capacity, the plant will employ about 150 persons over three 8-hr. shifts five days a week.

The company was established in 1919 as a parts supplier to the automobile industry. During 1954 Woodall expanded its activities by acquiring several concerns supplying the radio, television, household appliance, and building industries. Other manufacturing and sales facilities are located in Detroit and Monroe, Mich.; Mineola, N. Y.; Skokie, Ill.; Cleveland, Ohio; Laurel, Miss.; and San Francisco and El Monte, Calif.

Synthetic Products Co. is adding 30,000 sq. ft. of floor space to its present plant at 1636 Wayside Rd., Cleveland 12, Ohio, to augment the manufacturing and warehouse area. The company states that the expansion was necessary for the development of new and improved heat and light stabilizers for the vinyl industry and the increased list of products of stearates and specialties. It also announced that its technical service department has been expanded.

Synthetic Products has been in the production of stearates for over 33 years. The present plant manufactures metallic stearates, featuring aluminum, barium, cadmium, calcium, lead, lithium, magnesium, and zinc.

The Stabilizer Div. produces vinyl heat and light stabilizers, featuring barium, cadmium, tin, and alkyl and aryl phosphites. Synpro began the manufacture of vinyl stabilizers in 1945.

South Florida Test Service, 4201 N.W. 7th St., Miami 34, Fla., has constructed a new laboratory and shop annex building adjacent to its present main inland proving grounds and existing buildings. In addition, an auxiliary test field is being constructed adjacent to the building, providing an area of 275 by 275 feet.

Mount Hope Machinery Co. has opened a repair and service branch at 208 W. Griffith St., Charlotte, N. C., equipped to perform complete factory repair service on all of the company's machinery. Main office of the company is in Taunton, Mass.

COMPANY NOTES

Koppers Co., Inc., Pittsburgh 19, Pa., has agreed to purchase all the outstanding capital stock of **American Aniline Products, Inc.,** fifth largest manufacturer of dyestuffs in the United States, according to an announcement by **Fred C. Foy,** president of Koppers. Koppers plans no change in the corporate name of American Aniline and will operate it as a wholly-owned subsidiary under present management.

American Aniline, which started in this country in 1909 under the name of Swiss Colours Co., is engaged in the manufacture, distribution, and sale of dyestuffs, chemicals, intermediates, and auxiliary products which serve the plastics, textile, petroleum, paper, and leather industries. American Aniline has one plant located on a 48-acre tract in

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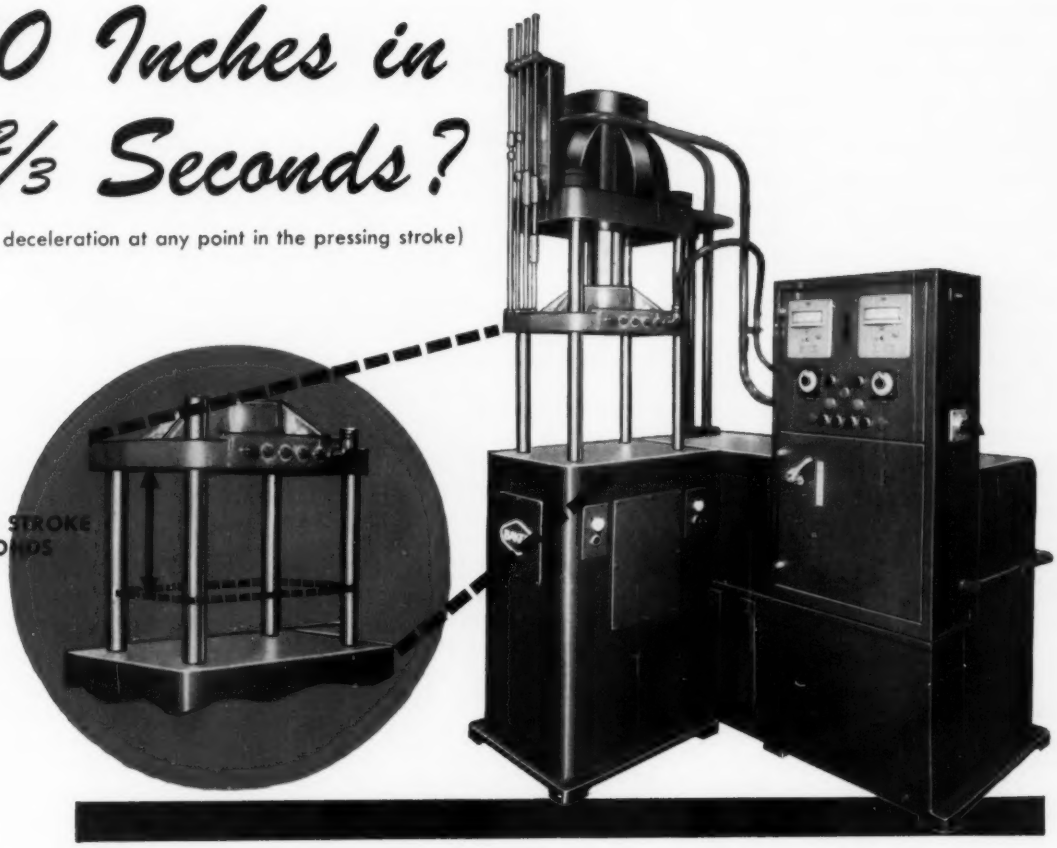

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Lock Haven, Pa., as well as a warehouse in New York City and laboratory-warehouse facilities throughout the United States. The firm's business in 1954 amounted to $10 million.

Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., announces that **Dr. Augustus B. Kinzel** was elected vice president in charge of research. He succeeds **Dr. George O. Curme, Jr.**, who has retired as vice president of the corporation but will continue as a director. Dr. Kinzel has been actively engaged in research at Union Carbide since 1926 and was appointed director of research in July 1954.

Roland Voorhees has been appointed associate director of development of the **Chemicals and Plastics Div.** His headquarters will be in the firm's New York offices, although a major portion of his time will be spent in maintaining technical contacts with the European chemical industry. One of Mr. Voorhees' most recent assignments was supervision of engineering work for Carbide's new Oxo plant in Texas City, Texas.

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., announces that **Ted M. Wennergren** has been appointed to the position of advertising manager of the **Plastics and Resins Div.**, replacing Harry W. Cyphers, Jr. who resigned to accept a position in the Chemical Div. of The Borden Co. Mr. Wennergren was formerly assistant to the advertising manager.

It was also announced by the company that **E. K. Hunt** has been named sales manager, succeeding C. J. Romieux who resigned. Mr. Hunt will direct the division's sales, promotion, marketing, and advertising functions. **Dr. N. B. Sommer** is now marketing manager of plastics. In addition to supervising the marketing of the company's existing group of thermosetting plastics, Dr. Sommer will direct marketing of American Cyanamid's new line of thermoplastic molding compounds. **R. G. Head** has been appointed marketing manager of resins, which includes the division's bonding, laminating, and coating resins lines, as well as polyester resins and phthalic anhydride. **Dr. V. V. Lindgren** has been named technical director of the division.

The company further announces the establishment of five regional sales offices and the appointment of the following regional sales managers: **W. F. Whitescarver** will manage sales activities in New York; **H. B. Freeman** in Los Angeles, Calif.; **C. W. Johnson** in Chicago, Ill.; **E. H. Trussell** in Boston, Mass.; and **C. T. Byron** in Cleveland, Ohio. **S. T. Dahl** has been named field sales manager.

Plax Corp., Hartford, Conn., announces that **Robert F. Elder** has been elected executive vice president of the company; **Robert A. Glaenzer**, formerly general sales manager, is now vice president in charge of sales; **C. Paul Fortner**, previously director of research, has been named vice president in charge of research and development; and **Richard S. Light** has joined the company as general factory manager. Mr. Elder has for the past five years been a marketing consultant, prior to which he had been vice president in charge of affiliated companies of Lever Brothers. Mr. Light was formerly vice president in charge of all procurement and production in the Snow Crop Div. of Clinton Foods, Inc.

Plax recently purchased a plant in Deep River, Conn., to supplement its manufacturing facilities in Stonington, Conn., and Louisville, Ky., and has started construction of a new research building and an administrative office building in Bloomfield, Conn.

National Starch Products, 270 Madison Ave., New York 16, N. Y., reports a sales volume of $8,300,000 for the first quarter in 1955 in comparison with $7,300,000 in the same period 1954.

Frank Greenwald, president of the company, states that National's new polyvinyl acetate resin plant in Meredosia, Ill., will go on stream after the middle of the year. Increased capacity at the Indianapolis starch plant will also contribute to company earnings before the end of the year. The balance of the company's $3.5 million construction program, including the doubling of research facilities in Plainfield, N. J., is now under way.

The General Industries Co.'s Sales Dept., Elyria, Ohio, announces the following appointments: **James M. Croak & Co.**, St. Louis, Mo., will handle the Missouri and Kansas area; **J. J. Daggon**, South Norwalk, Conn., and **R. A. Potter**, Summit, N. J., will cover the Eastern territory; **Al McConnell**, Chicago, Ill., has been assigned to the Illinois, Iowa, and Wisconsin territories; and **H. H. Welland**, Cincinnati, Ohio, will handle the Cincinnati and Kentucky area. **Earl Steele** has joined the sales staff of **D. G. Teeling Co.**, which covers the territory in Indiana for General Industries.

Mastic Tile Corp. of America, 99 Park Ave., New York, N. Y., has purchased **Wright Mfg. Co.**, Houston, Texas, manufacturer of flexible vinyl tile flooring and rubber tile. The acquisition of the property, business, and assets of Wright will add $12 million to Mastic's annual sales volume and will establish Mastic Tile as one of the largest producers of resilient tile flooring and wall products.

Adamson United Co., 730 Carroll St., Akron 4, Ohio, reports that **F. L. Dawes**, president and general manager of the company, was elected to the board of directors of **United Engineering & Foundry Co.**, Pittsburgh, Pa., at United's annual stockholder's meeting. **Mark M. Wolff** was named secretary of Adamson United Co. at the same meeting.

Frank W. Egan & Co. announces that **C. V. Blatter** has joined the sales engineering staff and will be active in the sale of Egan extruders and allied plastics processing equipment. **A. G. Russell** has been appointed sales engineer and will handle paper converting equipment.

The Egan plant has been moved from Bound Brook, N. J., to a new, modern building in Somerville, N. J.

National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., announces that **A. D. Winquist, Jr.** and **Marcus French**, for the past several years engaged in chemical research with the New Products Div., have been

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transferred to the Chemical Sales Dept.; Mr. Winquist to sales service; and Mr. French as a technical sales representative.

The new assignments are part of an expansion program incident to completion of new facilities for production of adipic acid, caprolactam, and other chemicals at Hopewell, Va., and for maleic anhydride, fumaric acid, aniline, and isocyanates at Moundsville, W. Va.

The Society of the Plastics Industry, Inc., 67 W. 44th St., New York, N. Y., has named **Theodore S. Lawton**, sales manager, Film and Sheeting, **Monsanto Chemical Co.**, as chairman of the newly formed Vinyl Film End-Product Standards Committee.

Industrial Molded Products Co., Inc., 5201 N. Avondale Ave., Chicago, Ill., announces appointment of the following new officers: **Carl E. Benson** has been named president of the company; **Peter C. Barsanti**, vice president and treasurer; and **John P. Roche**, secretary.

Continental Can Co.'s purchase of patents and production facilities of **Vaporized Metal Coatings, Inc.**, Roosevelt, N. J., has been approved by the directors of the two firms.

American Cyanamid Co. announces that its Wallingford plant will be shut down for vacation from July 17 through July 30, and the Bound Brook plant from August 7 through August 20.

Witco Chemical Co. has opened new executive offices at 122 E. 42nd St., New York 17, N. Y. Occurring on the company's 35th anniversary, the move reflects Witco's growth by the acquirement of space more than twice as large as previously occupied.

The American Chemical Society has moved to larger quarters at 2 Park Ave., New York, N. Y.

Gar Wood Industries, Inc., Wayne, Mich., has established a **Chemical Structural Div.** at 800 Lowell St., Ypsilanti, Mich. **W. Russell Bailey**, director of research of the new division, was recently associated with the U. S. Bureau of Standards and, prior thereto, was president of Allied Plastics Corp., Washington, D. C., which was engaged in chemical research for the Government and commercial chemical manufacturing companies.

Plastics Color Co., 233 Broad St., Summit, N. J., has named **Herbert Lorenz, Inc.**, 299 Madison Ave., New York 17, N. Y., as its export representative. Mr. Lorenz was formerly affiliated with American Cyanamid Co. and was president of South American Minerals & Merchandise Corp.

Hugh Hall, formerly president and general manager of Plastic Research Products, has formed his own molding company, **Therm-O-Plastic Products, Inc.**, No. Logan St., Urbana, Ohio. The new firm now has in operation five H-M-P injection molding machines ranging from 6 to 28 ounces. **R. E. Davis**, formerly sales manager of Hydraulic Press Mfg. Co.'s Plastics Machinery Div., is in charge of plant operations.

Premier Plastic Products, Inc., 3982 Broadway, Gary, Ind., recently formed, will specialize in custom injection molding. Officers of the new firm are: **Theodore Nering, Jr.**, president; **Willy Kuehnle**, vice president; and **Glen D. Smith**, secretary-treasurer.

Premier Plastics also plans to offer facilities for fabrication, finishing, and assembly of plastic parts and products.

The Harshaw Chemical Co., Cleveland 6, Ohio, has moved its New York branch office to Hastings-on-Hudson, N. Y., in the plant of the company's recently acquired subsidiary, **Zinsser Co., Inc.**, manufacturer of dyestuffs, organic dry colors, and fine chemicals.

Riverdale Plastic & Chemical Corp., Culver City, Calif., has been named West Coast sales representative for Poly-Eth polyethylene, manufactured by **Spencer Chemical Co.**, Kansas City, Mo.

Headed by **Sam Silberkraus**, Riverdale will also have the sales services of **West Coast Plastics Distributors**, Los Angeles, Calif., which has been active for the past 10 years in the marketing of machinery and equipment to the plastics industry in the area. It will be the firm's first venture in polyethylene.

Lustra-Cite Industries, Inc., 249 W. 34th St., New York 1, N. Y., has acquired **Scheuer Creations, Inc.** and will continue to manufacture most of the items previously made by Scheuer.

National Starch Products, 270 Madison Ave., New York 16, N. Y., has appointed **Dr. Carlyle G. Caldwell, John F. Fitzgerald, Dr. Robert W. Merritt**, and **S. F. "Woody" Thune** as vice presidents of the company. Six of National's vice presidents average about 43 years of age and have been with the organization an average of 20 years; for all but one, National is and has been his only job.

PERSONAL

Robert D. Scott, formerly general manager of plants, has been appointed vice president of manufacturing of **B. F. Goodrich Chemical Co.**, Rose Bldg., Cleveland, Ohio. He succeeds **William I. Burt**, who was elected president of **Goodrich-Gulf Chemicals, Inc.**

Herbert H. Clarke, Jr. has been named executive vice president of **The Borden Co.'s Chemical Div.**, 350 Madison Ave., New York 17, N. Y. Mr. Clarke joined the company as a salesman in 1940.

John S. Brice has joined **Goodyear Tire & Rubber Co.'s Chemical Div.** as a field representative in the Southeastern territory, with headquarters in Atlanta, Ga. He will specialize in sales and service to the textile industry in Goodyear's line of Chemigum, Pliolite, and Pliovic latices, all of which are finding application as binders, sizes, finishes, or saturates.

Joe D. Robertson has been named a sales representative of the **Watson-Stillman Co., Div. of H. K. Porter Co., Inc.**, Roselle, N. J. Mr. Robertson will handle the company's line of hydraulic presses for the plastics, metalworking, extrusion, and general industries in the Carolinas, Georgia, and parts of Florida.

Harry M. Zimmerman is now general manager of **Seiberling Rubber Co.'s Plastics Div.**, Newcomerstown,

Ohio. He succeeds Robert S. Price who has resigned. Mr. Zimmerman was formerly associated with B. F. Goodrich Chemical Co. as a development engineer.

Edwin H. Ahlefeld, Jr. has been appointed assistant general sales manager of **Farrel-Birmingham Co., Inc.**, Ansonia, Conn.

Oliver P. Stroup has joined **Acheson Dispersed Pigments Co.**, 2250 E. Ontario St., Philadelphia, Pa., as an applied research chemist. Mr. Stroup's former affiliations were with Ciba Co. and General Chemical Div., Allied Chemical & Dye Corp.

Mark B. Stringfellow has been appointed to the newly created position of manager of market development of **Spencer Chemical Co.**, Kansas City, Mo. Mr. Stringfellow comes to Spencer from Nopco Chemical Co., where he was manager of the Plastics Div.

Walter Platte has joined **B. F. Goodrich Co.**, Akron, Ohio, as designer and stylist of all Koroseal materials for consumer application.

J. W. Lelivelt has been appointed to the newly created post of manager of manufacturing of **Kelvinator Div., American Motors Corp.**, Detroit, Mich. Mr. Lelivelt, who has been works manager of the company's Grand Rapids plant for the past seven years, will be responsible for the manufacturing and procurement at Kelvinator's Grand Rapids and Detroit plants and plastics operations in Michigan and Wisconsin. He will make his headquarters in Detroit.

Roger H. Lawton has been appointed plant manager of **The Standard Machinery Co.**, Mystic, Conn. **Davis-Standard Sales Corp.**, Mystic, is the sole selling agent of Standard Machinery, which specializes in the manufacture of extruders for plastics and rubber, and electrical wire insulating machinery.

R. K. Buffington has joined **General Plastics Corp.**, 2027 Granville Ave., Los Angeles, Calif., as sales manager. Mr. Buffington was formerly assistant sales manager of U. S. Rubber Co.'s Royalite Div.

Ned L. Roberts has been named Western representative of **Gomar Mfg. Co., Inc.**, Newark, N. J., manufacturer of metallized acetate, buty-

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rate, and other thermoplastic sheetings. Mr. Roberts' headquarters will be at 14634 Round Valley Dr., Sherman Oaks, Calif.

Carl F. Freedman, formerly vice president and general manager of **American Agile Corp.**, 5461 Dunham Rd., Maple Heights, Ohio, has been appointed executive vice president.

Henry R. Merrill, formerly assistant general sales manager and a director of **Behr-Manning Div., Norton Co.**, Troy, N. Y., has been named general sales manager of the company. He succeeds the late John M. Cook.

B. Franklin Conner has retired as president of **Colt's Mfg. Co.**, Hartford, Conn., after 30 years with the company. He will continue to serve the company as a member of the board of directors.

Robert G. Werner has been elected vice president and general manager of **Vulcanized Rubber & Plastics Co.**, 261 Fifth Ave., New York, N. Y.

C. Todd is now sales representative for **Pribble Plastics Products, Inc.**, New Haven, Ind., and will handle the sale of compression and transfer molded parts in the greater St. Louis, Mo., area.

Howard Feingold has joined **Wyndmoor Mfg. Corp.**, 306 Lyons Ave., Newark 8, N. J., as manager of the Plastics Div., which specializes in laminating, coating, and embossing of plastics, textiles, foils, and papers. Mr. Feingold was previously connected with Define Products Corp. and Velveray Corp.

John C. Cotner has resigned as president and general manager of **The Hydraulic Press Mfg. Co.**, Mount Gilead, Ohio. He will continue as a director of the company.

Henry R. Lasman has joined the technical staff of **National Polychemicals, Inc.** He will be in charge of the new rubber and plastics laboratory recently completed at the company's Wilmington, Del., plant site.

William F. Condon has been named general sales manager of **Spunlite Corp.**, Miami, Fla., and 99 Park Ave., New York 16, N. Y. His

headquarters will be at the New York office. Mr. Condon was formerly with Owens-Corning Fiberglas Corp. Spunlite, a division of **Waterbury Companies, Inc.**, produces fibrous-glass reinforced plastics building panelling.

Robert A. Christman has been appointed chief chemist of **Mobay Chemical Co.'s** new polyurethane plant now being constructed in New Martinsville, W. Va.

Charles L. Becker, Jr. is now manager of customer relations of **Textileather Div., The General Tire & Rubber Co.**, Toledo 3, Ohio.

Lewis C. Wallace has been named manager of process development of **Crown Cork & Seal Co., Inc.**, Baltimore 3, Md.

Leon Crumbliss has joined **Victory Mfg. Co.**, 1720 W. Arcade Place, Chicago, Ill., plastic molders, as chief tool engineer. Mr. Crumbliss was formerly with Continental Can Co.

Jerome T. Coe has been appointed sales manager of **General Electric Co.'s** Silicone Products Dept., Pittsfield, Mass.

George Wash, formerly manager of fertilizer sales of Phillips Petroleum Co., Bartlesville, Okla., has been appointed director of the newly formed plastics sales division of Phillips Chemical Co., wholly-owned subsidiary of Phillips Petroleum. Mr. Wash will be in charge of all sales and technical services connected with Phillips new polyethylene which will be marketed under the trade name Marlex.

Deceased

J. Paul Smith, president of **The Visking Corp.**, Terre Haute, Ind., died suddenly at the age of 64. Before Mr. Smith joined Visking in 1931 he had been with Du Pont, where he was instrumental in bringing cellophane to this country from France, and where he headed-up development work on that material.

Norman J. Elder, vice president and manager of **Adamson United Co.'s** Calender Div., Akron, Ohio.

Purcell DeHan, vice president of **Peerless Molded Plastics, Inc.**, Toledo, Ohio.

Bernard Rifkin, president of **Maryland Plastics, Inc.**, 95 Madison Ave., New York 16, N. Y.

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FOR SALE: Injection Molding Machines, excellent condition. 8 Oz. Leominster, 12 Oz. Impco. Priced very low. RELIANCE MOLDED PLASTICS, Woonsocket, Rhode Island.

FOR SALE

Lester 3S-27-12 Injection Molding Machine, 12 oz. capacity. Excellent running condition, can be seen in operation, good buy.

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FOR SALE: New imported extruders. Latest developments, self-contained. Moderately priced. For details write or call: ACME MACHINERY & MFG. CO. INC., 102 Grove Street, Worcester, Mass. Tel.: PLeasant 7-7747.

FOR SALE: Injection Machines, 4, 8, 12, 24, 32 oz. Reed-Prentice, 6, 16 oz. HPM, 8 oz. Lester. Compression presses, 650 ton Ohio, 200 ton HPM, 200 ton Watson, 200 ton Elmes, 50 ton Stokes, 15 ton Stokes. 10 HP Ball & Jewell Grinder. Late type, Milling machines. Lathes, Drills, Surface Grinders, Partial listing of equipment, list your needs or machinery for sale with us. LINN MACHINERY CO., 1030 W. North Ave., Chicago, Ill.

LEOMINSTER 8 oz. Injection Molding Machine. Plastic and Rubber Equipment. Farrell 16"x48", 15"x36" and 6"x12", 2 roll mills. Mills and Calenders up to 84". New Seco 6"x12" and 6"x16" Lab. Mixing Mills and Calenders. Rubber Plastic Extruders Wat.-Stillman 75 ton automatic Molding Press 20"x20" platens. 200 ton Hobbing Press 18"x14" platens. HPM 200 ton 30"x48" platens. New Loomis 340 ton. 24"x56" platens. 200 ton Brunswick 21"x21" platens, 14" ram. 150 ton Bolling 20"x20" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & single Punch Preform Tablet Machines ⅜" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE: 200 T. HPM Fastraverse 84"x60" Pl. Fiberglas Press & Williams Preformer. Injection Presses: 4, 8, 12, 16, 24 & 32 oz. Reeds. 2, 4 & 9 oz. HPM. 6, 8, 12 oz. Lesters. 4 oz. Lewis. 1 & 2 oz. VanDorn. 1 oz. Vertical Pacemaker. 1 complete Injection plant w. 6 press, bldg. vct. lot, exc. moneymaker. Scrapgrinders, Ovens, Meridian Temperature Circulator. Compression presses: 50, 100, 150, 600 tons incl. Stokes Standard, 15 tons Stokes Automatics. Preform presses—25 Mears-Kane Gasboiler—30 HP oilheat. Cyclotherm Boiler. Equipment to be inspected in operation (Midwest). List your surplus equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

VACUUM FORMING MACHINE: New 2 table unit—32x53 size. Complete with all mers, controls and pumps. Can be bought cheap. Write Box #631, Peabody, Mass.

FOR SALE: One Heavy Duty 42" Thropp Mill with drive and motor. One Laboratory Mill, One late model RC100 Windsor Twin Screw Extruder, one 4½" Extruder used for cellulose nitrate, one 4½" Extruder with conveyor used for casein. One 4½" Oil heated Hartig Extruder, all extruders complete with motors, various Hydraulic Presses, reasonably priced. Reply Box 72355, Modern Plastics.

FOR SALE: 60 oz. H.P.M. 48 oz. Lester, $45,000. 40 oz. H.P.M., $28,000. 32 oz. Lester, 1950, $22,000. 32 oz. Reed-Prentice, 1950, $26,000. 22 oz. Reed-Prentice, 1947, w/plunger advance, $13,500. 22 oz. Reed-Prentice, 1945, excel., $11,000. 16 oz. H.P.M., $9,500. 16 oz. Watson-Stillman, $16,500. 12 oz. Reed-Prentice, 1950, $10,500. 12 oz. Lester, $5,000. 12 oz. Watson-Stillman, 1948, $10,000. 8 oz. Reed-Prentice, 1946, $6,500. 8 oz. DeMattia, $4,500. 8 oz. Lester 2¼L, $5,500. 8 oz. Reed-Prentice w/10 oz. cyl., $8,500. 8 oz. Leominster, $5,000. 6 oz. Reed-Prentice, $3,500. 6 oz. Lester, $4,000. 6 oz. DeMattia, $3,250. 6 oz. Heisgen, $2,500. 4 oz. H.P.M., $3,350. 4 oz. Reed-Prentice, 1948, $5,200. 4 oz. Impco, $6,850. 4 oz. Lester, $3,000. 4 oz. Lester, Vertical, $4,500. 3 oz. Fellows, $6,500. 2 oz. Dowding & Doll, $3,350. 2 oz. Reed-Prentice, $1,350. 2 oz. DeMattia vert., $750. 3¼" Hartig extruder, $2,500; new powder mixers, $315; 150 ton closure presses; 6 tray oven, $150; 80 ton transfer & compression press, new, $4,250; #235-A Stokes. ACME MACHINERY & MANUFACTURING CO., 102 Grove Street, Worcester, Mass. Tel: PLeasant 7-7747.

FOR SALE: Blaw-Knox 15 gallon Resin Kettle Pilot Plant, type 347 stainless steel, jacketed and agitated, 150# pressure with Condenser and Receiver, Variable speed drive, Controls, etc. Excellent condition. Also #1½ B & J Stainless Steel Cutter and 2—Kux Model 25 Rotary Presses. PERRY EQUIPMENT CORP., 1429 North 6th Street, Philadelphia 22, Pa.

FOR SALE: One Reed-Prentice 24 ounce Injection Molding Machine. Fully equipped with 40 H.P. motor, Wheelco instruments, timers, etc. This machine is in very good condition, has had excellent maintenance and can be seen running in regular production. PLASTIC MOLDED PRODUCTS CO., 6044 N. Pulaski Rd., Chicago 30, Illinois.

AVAILABLE AT BARGAIN PRICES

Mitts & Merrill 15CD Rotary Cutter. J. H. Day, from ¾ up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Baker Perkins Heavy Duty (Steam Jacketed) Double Arm, from 5 to 200 gal., Mixers (Unidor and Vacuum also). Gemco 2000 lbs. 56 cu. ft. Double Cone Blender. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers. Day, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2RP and 3 RP Rotary & #5½ Tablet Machines. Carver Laboratory 20 ton hydraulic Press. Package Machy. FA, FA2, FA4, U4, Miller, Hayssen, Wrap-King, Scandia, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machy. requirements. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette St., New York 12, N. Y.

FOR SALE: 3—National 10"x20", 6"x14" Two Roll Mills; 1—Baker Perkins 100 gal. S.S. double arm, jacketed Vacuum Mixer; 3—Baker Perkins 100 gal., 50 gal. jacketed double arm Mixers; 2—Stokes Rotary Preform Presses DD2, D3; 1—Stokes Model "R" single punch Preform Press; 1—Kux Model 15-25 double action Rotary Press; 2—Cumberland #0 Rotary Cutters; Also: Sifters, Cutters, Banbury Mixers, etc., partial listing; write for details; we purchase your surplus equipment; BRILL EQUIPMENT CO., 2407 Third Ave., New York 51, N. Y.

FOR SALE: One-ounce Van Dorn manually operated injection machine 2 HP, 3 phase with spare 2 HP single phase motor. Has oil cooler added. Space needed. $750.00 for fast sale. COMPONENT MANUFACTURING SERVICE, INC., Component Park, West Bridgewater, Mass.

(Continued on page 234)

CLASSIFIED ADVERTISING

(*Continued from page 232*)

HYDRAULIC PRESSES: Elmes 1000 Ton Hobbing Press, M-D Pump. Erie 4000 Ton and Baldwin-Southwark 3600 Ton Belt Presses. Birdsboro 2000 Ton, Farrell 1000 Ton, HPM 750 Ton, Watson-Stillman and HPM 100 Ton, HPM 35 Ton Molding Presses. Watson-Stillman 30 Ton Lab Presses. Stokes Model 200 D-3 and Model 235 Automatic Presses. Stokes 200 Ton, 150 Ton and 100 Ton Semi-Automatic Presses. INJECTION MOLDING MACHINES: Various makes, 2 Oz. to 22 Oz. EXTRUDERS: Lab Type, 1" Electrically Heated; Royle No. 1 Rubber Extruder and Larger. TABLET MACHINES: Stokes R, T, RDS-3 and Colton No. 5 and No. 5½. MISCELLANEOUS: Baker-Perkins 2¼ Gal. Mixer, MPM Pelletizer, B & J 1 HP Rotary Cutter, Mills, Calenders, Grinders, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683P Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. WHAT HAVE YOU FOR SALE? WHAT ARE YOU LOOKING FOR?

MACHINERY and EQUIPMENT WANTED

WANTED: Complete water wash spray booth for making metal spray molds and automatic vinyl sheeter. Furnish details and prices. DEITZ MIRACLE LENS COMPANY, 360 Highland Avenue, Passaic, N.J. Tel.: GRegory 2-2576.

WANTED: Stokes DS 3 preform press in good condition. Preferably late model complete with punches. Also job lots moldable urea. Reply Box 70655, Modern Plastics.

WANTED: Plastic Grinder 2½ H.P. Electronic Heat Sealing Machine. KOHNER BROS., 155 Wooster Street, New York 12, N.Y. ORegon 4-7578.

MATERIALS FOR SALE

FOR SALE: 20,000 lbs. each Red and Blue Styrene Pellets. Sunplus lot Red Acetate Pellets—15,000 lbs. Both attractively priced. We are also in the market for all surplus plastic scrap and powder. PLASTIC MOLDING POWDERS, INC., 2004 MacDonald Avenue, Bklyn., N. Y. Tel.: ES 5-7943.

WE ALWAYS SELL: Scraps of Polyvinyl Chloride Sheets, classified by shades, welded and multicolored. Wanted broker introduced near clients using Polyvinyl Chloride Sheet Scraps. Write to ETABLISSEMENTS KATZ, Avenue Paul-Vaillant-Couturier, Gentilly, (Seine), France. Tel.: ALE 43-29.

FOR SALE: High Impact Polystyrene. You can save money by using our reprocessed high impact polystyrene pellets available in a variety of bright colors as well as matched colors. Also, bargains in bright colors cellulose acetate and other thermoplastics. Samples on request.
A. BAMBERGER CORPORATION
703 Bedford Ave., Brooklyn 6, N. Y.
Telephone MAin 5-7450

FOR SALE: 10,000 pounds Owens-Corning-2 ounce glass mat. All pieces are fairly long and range from 2" to 12" in width. Price 10 cents per pound F.O.B. Houston, Texas for 10,000 pounds, 12 cents per pound for less than 10,000. HANSZEN PLASTICS COMPANY, 835 So. Good-Latimer Expressway, Dallas 10, Texas.

FOR SALE: Fiberglass Cloth 42 in. wide, $1.10 yd. Clear Vinylite sheets 20x50x.040, $3.25 sheet. Polyester Resin, $7.25 gal. Trade .040 Vinylite sheets for Plexiglas or Vinylite .060 or heavier. Also want Nitrate, Butyrate, Acetate and Vinylite scrap. STEVENS INDUSTRIES, 771 So. State St., Chicago, Ill.

HIGH DURAMETER VINYL
Clear, White & Colors. For Extruders & Compounders. In continuous Supply.
CLAUDE P. BAMBERGER, INC.
152 Centre Street, Brooklyn 31, New York, Tel.: Main 5-5553.
Not connected with any other firm of similar name.

MATERIALS WANTED

WANTED: Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. DUKE PLASTICS CORP., 584 Broadway, Brooklyn 6, N. Y. Tel.: EVergreen 8-5520. Note new address!

WANTED: Plastics Scrap and Rejects of all kinds, ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. BAMBERGER CORPORATION
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

SCRAP PLASTICS: All forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. ACETO CHEMICAL CO., INC., 40-40A Lawrence St., Flushing 54, N. Y. INdependence 1-4100.

ALWAYS BUYING surplus virgin and reground styrene, acetate, butyrate, nylon, acrylic and ethylcellulose. For your best market contact GEM CITY TRADING, P.O. Box 941, Dayton, Ohio. Tel.: HE-2121.

WANTED: PLASTIC SCRAP. Polyethylene, Polystyrene, Acetate, Acrylics, Butyrate, Nylon, Vinyl. GEORGE WOLOCH, INC., 82 Beaver St., New York 5, N.Y.

CLEAR ACRYLIC MOLDING POWDER SCRAP wanted by end user either reground or unground. Also nylon molding powder scrap needed. Highest cash prices paid. Reply Box 72055, Modern Plastics.

PLASTIC SCRAP WANTED: All types and grades, Polystyrene, Acrylic, Acetate, Butyrate, etc. Interested in both large and small accumulations. Send us a description and small representative sample, and we will quote promptly. SUCCESS PLASTICS RECOVERY WORKS, INC., P.O. Box 596, 7200 Pendleton Pike, Indianapolis, Indiana or Telephone Cherry 2919.

MOLDS FOR SALE

INJECTION MOULDS FOR SALE OR LEASE ON ROYALTY BASIS: House Numbers, Switch Plates, Base-Outlet Plates, Wall Protectors, Cord Pulls, Keyholders, Figurines, Picture Frames, etc. All fast sellers in luminous or non-luminous material. Will supply sample stock at actual cost so you may prove this in advance before entailing any mould cost. MADISON MILLS, 303 Fourth Ave., New York 10, N.Y.

FOR SALE OR EXPORT: Metal drape and vacuum forming shell molds of Xmas items for illuminated displays. Santas (all sizes), sleighs, candles, angels, reindeer, candy canes, bells, etc. All for half of original cost. Also many other molds in stock for novelties, etc. Reply Box 73555, Modern Plastics.

USED INJECTION MOLDS for sale: 6-cavity Men's comb, 12-cavity Pocket comb, 1-cavity Salad bowl, 4-cavity Cereal bowl, 1-cavity Picnic plate, 4-cavity Tea cup, 3-cavity Saucer, 1-cavity Bread basket, 4-cavity utility box, 2-cavity Candy box, 4-cavity 8 oz. Tumbler, 8-cavity Party basket, 4-cavity Butter dish, 1-cavity Dishpan, 6-cavity Wall tile, 2-cavity Water pitcher, 1-cavity Silverware tray, 8-cavity Clothes hooks, 12-cavity Salt & Pepper shaker, 4-cavity Juicer, 6-cavity Repeater gun, 8-cavity Santa Claus, 8-cavity 8 inch Doll, 8-cavity Autobus, 8-cavity Bumper truck, 6-cavity Harmonica, 4-cavity Rattle, 4-cavity Airplane, 40-cavity Charms. Above molds in good condition for 4, 6, and 8 oz. machines. Quotations and samples available. ALFRED A. ROSENTHAL, 3 Park Row, New York. Cables: Aroplast. Selling used molds for 22 years.

MOLDS WANTED

WE ARE INTERESTED in acquiring molds for export to European countries, either inactive, or active with license, to produce abroad. Interest is for novelties, toys, kitchen articles, utensils, etc. Offers with specifications, prices and samples where available, will be submitted to our clients for prompt action. Please address replies to HARRY KRIEGER COMPANY, 152 West 42 Street, New York 36, N.Y.

PLANT FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 72255, Modern Plastics

HELP WANTED

SUPERVISOR-CHEMIST: Thoroughly experienced treating with melamine and phenolic resins for decorative laminates to take full charge of large treating department. Excellent salary, bonus, rapid promotion with expanding Eastern manufacturer. Send resume. Box 72755, Modern Plastics.

MAN to assume complete management new tool and die plant, to design and make injection and other type molds. Delightful southern location. Reply Box 73355, Modern Plastics.

DESIGN GROUP OPENING
Do you have: 1. An interest in and a technical background for the product design aspects of electronic equipment development? 2. The ability to lead a group of engineers through Problems of high altitude?, Subminiature techniques?, Heat transfer, etc? If you believe that you have these talents, can't we get together? Please write, giving full particulars concerning education and experience to Mr. A. H. Nile, RAYTHEON MFG. CO., (Boston Area), 190 Willow Street, Waltham, Mass.

WANTED: PLANT SUPT-GENERAL FOREMAN to locate in Florida with experience in vacuum forming. Experience in reinforced plastic desirable but not essential. Reply stating age, education, experience and salary requirements. Reply Box 70755, Modern Plastics.

CHEMIST with vinyl calendering and vinyl plastisol experience required for Technical Sales Service. Progressive company. Metropolitan area. Replies held confidential. Reply Box 72855, Modern Plastics.

WANTED
Mechanical Engineer experienced in design and development of moderate to heavy machinery. Knowledge of hydraulics and familiarity with plastics helpful but not necessary. Commensurate salary. Reply in strict confidence to Box 71155, Modern Plastics.

DEVELOPMENT CHEMIST OR CHEMICAL ENGINEER: Interested in industrial or organic chemical field, such as alkyd resins. Duties to be mainly as liaison man to help set up and develop known licensed process within parent company. Metropolitan New York area. Send complete resume and salary expected. Reply Box 70455, Modern Plastics.

VINYL CHEMIST
Experienced heavy or light gauge calendering. Good salary, liberal insurance, hospitalization and retirement. Replies treated confidentially. Reply Box 70155, Modern Plastics.

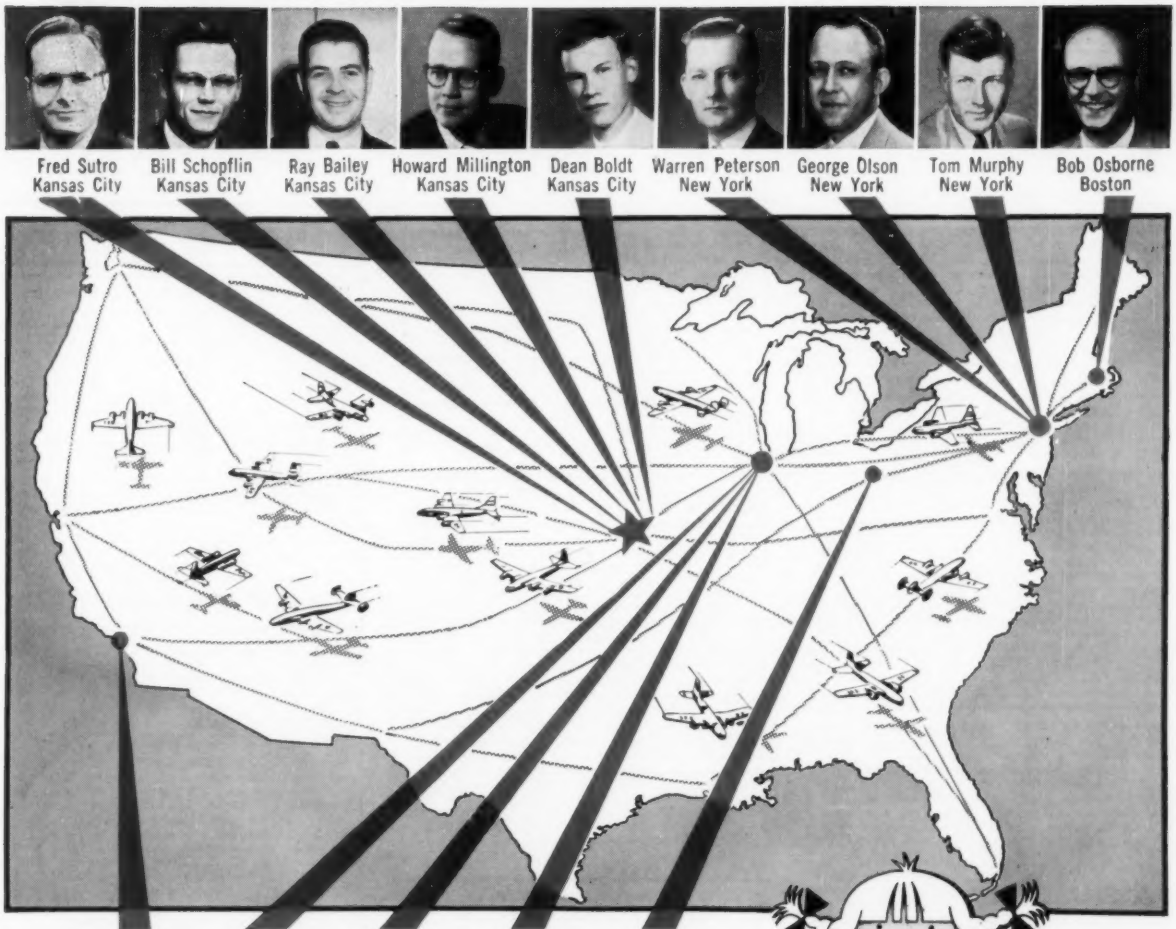
ENGINEER with experience in extrusion, laminating and coating. Supervisory experience and ability to take charge of production. Must have a successful background. Location in Middle West. Exceptional opportunity. Submit detailed resume. Reply Box 71055, Modern Plastics.

WANTED
Young Mechanical Engineer interested in development of machinery for the plastic molding industry. Liberal salary and company benefits. Write in complete confidence to Box 71255, Modern Plastics.

WANTED: Plastic salesman for the New York City area and vicinity, having experience in squeeze bottle and injection molded items. Write giving age and brief experience to SCOTT H. ADAMS, 834 Plaza Place, Ocean City, New Jersey.

(*Continued on page 236*)

These men have one job: To Serve You!



Fred Sutro, Kansas City
Bill Schopflin, Kansas City
Ray Bailey, Kansas City
Howard Millington, Kansas City
Dean Boldt, Kansas City
Warren Peterson, New York
George Olson, New York
Tom Murphy, New York
Bob Osborne, Boston

Sam Silberkraus, Los Angeles
Ken Wright, Chicago
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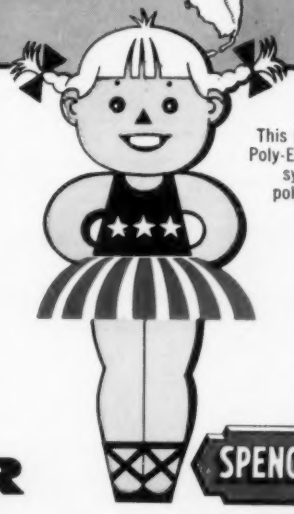
Pete Dornik, Chicago
Carl Virgin, Ohio



This little miss is Poly-Eth, Spencer's symbol for polyethylene.

Meet the men of Spencer Chemical Company's Polyethylene Sales Team. Backed by strong Tech Service, they're ready now to help you plan a future in your business for "Poly-Eth" (Spencer's brand of polyethylene). Write today and find out what Spencer Service can mean to you.

Poly-Eth™ by SPENCER

SPENCER CHEMICAL COMPANY • 610 DWIGHT BLDG., KANSAS CITY, MISSOURI

CLASSIFIED ADVERTISING

(*Continued from page 234*)

FLOOR TILE CHEMIST WANTED
Experienced manufacture Vinyl Tile. Good salary, liberal insurance, hospitalization and retirement. Replies will be confidential. Reply Box 70255, Modern Plastics.

ANALYTICAL CHEMIST: Graduate Chemist to head up a small control and analytical research laboratory. Main interest is alkyd resin. Metropolitan New York area. Send complete resume and salary expected. Reply Box 70555, Modern Plastics.

INJECTION MOLD SPECIALIST WANTED
Excellent opportunity for top mold maker to set up machine shop to maintain and build injection molds for proprietary molder. AAA1 Mfg., located in pleasant South Michigan Community will assist in relocating. Permanent position for experienced man with initiative. Must be able to work with a minimum of supervision. Send resume. Reply Box 73055, Modern Plastics.

REINFORCED PLASTICS ENGINEER with particular experience in honeycomb structures to take charge of production and development program. Wonderful opportunity for top man. Salary commensurate with ability. Send resume and salary requirements to Box 70055, Modern Plastics.

CHEMIST—VINYL COATING: Require chemist experienced plastisol formulations for fabric coating operation. Good opportunity. All replies confidential. Our employees know about this ad. Reply Box 71355, Modern Plastics.

PLASTIC DEPT. MANAGER: Man to manage medium size plastic molding dept. Must have supervisory exp. in both compression and injection molding. Must be thoroughly familiar with and capable of supervising and advising on all problems relating to plastic molding dies and equipment. This is an invitation for an experienced, high caliber man to join a sound organization with a good background and an excellent future. Contact Mr. Evans or Mr. Theis at MAYFAIR MOLDED PRODUCTS CORPORATION, 4440 N. Elston Ave., Chicago 30, Illinois.

MANUFACTURER'S REPRESENTATIVES PRINTED POLYETHYLENE BAGS: Many exclusive territories open east of the Mississippi for men or organizations with allied, non-competitive lines of packaging materials or supplies to earn sizable additional income selling custom-printed polyethylene bags directly to industrial, soft goods, and food packagers. HERB-SHELLY, INC., Farmington, Minnesota. Att: General Sales Manager.

PLASTICS ENGINEER: Research and development engineer or chemist experienced in formulation and usage of inorganic colorants for resins. Our employees know of this opening. Reply Box 70355, Modern Plastics.

CHEMICAL ENGINEER OR CHEMIST
Engineer with several years experience working in the field of glass reinforced moldings and laminates. Must be thoroughly familiar with all types of resins and filler systems. Will be engaged in development of new materials and fabricating techniques and will be required to work with an aggressive competent group of Engineers and Technicians. Experience with the requirements of the electrical industry helpful. Salary open. All replies held strictly confidential. Send complete resume including present salary to Dr. G. C. Gainer, WESTINGHOUSE ELECTRIC CORPORATION, Materials Engineering Department, East Pittsburgh, Pennsylvania.

INJECTION MOLDING ENGINEER: Experienced in mold design and product design. Full knowledge regarding molding of all thermoplastics. In addition, must have ability to estimate tooling costs and piece costs. Reply Box 71855, Modern Plastics.

PLASTICS ENGINEER
Production and Development Engineer; experienced in formulation, evaluation and competitive analysis of all phases of dry blends and conventional extrusion compounds, plastisols, surface coatings, adhesives and sealers. Plant is located in Northwestern Ohio. Reply, stating age, education, experience and salary requirements. Box 73155, Modern Plastics.

CHEMIST: BS or MS in Organic Chemistry, up to three years experience in polymerization or process development. For work in preparation of new polyvinyl acetate based products, improvements in current commercial items, and semiwork and plant problems involved in the development of polyvinyl acetate resins. The vast and varied scope of Celanese activities in the plastics, chemical and textile fields creates continuing opportunities for qualified men . . . opportunities to grow with Celanese, and to help keep Celanese ahead in these fields. Please send resumes, in confidence to Mr. J. A. Berg, CELANESE CORPORATION OF AMERICA, Morris Court, Summit, N. J.

PRODUCT DEVELOPMENT ENGINEER
PLASTICIZERS: Prominent and progressive manufacturer of organic chemicals offers young graduate chemists and chemical engineers an unusual opportunity to join its rapidly expanding Product Development Department. Position requires 2-5 years experience in sales and market development or technical service with special emphasis in the plasticizer industry. Duties will entail: program planning, field contact, recommendations for application studies, product specifications and preparation of trade literature and reports. If you have a good technical background combined with a sales personality write giving full particulars of age, education, experience and salary requirements. Box MP 492, 221 W. 41 St., N.Y.C. 36.

GENERAL MANAGER WANTED for Plastics Injection Molding Plant. Must have successful experience in the Management of injection molding Operation, Sales, Development Engineering, and Technical Service. Full knowledge required of Piece and Mold design, Estimating, Production Methods, Cost Analysis, and Equipment. We are looking for a capable and responsible administrator with full plastics experience to take complete charge of our unusually modern and well-equipped custom injection molding plant. For a permanent position, a substantial income, and a real opportunity, Reply Box 71955, Modern Plastics.

ENGINEERS — SALESMEN — ADMINISTRATORS — EMPLOYERS: Confidential, rapid and professional service for nation wide placement in the Plastics field. Write giving age, education and brief experience. Employers send us job description. We will let you know how we can help you by return mail. GRAEBNER'S PLASTICS EXCHANGE "The Nation's Largest", 116 South Michigan, Chicago 3, Illinois.

SITUATIONS WANTED

CHEMICAL ENGINEER: Age 29, 8 years diversified experience in product development and production. Plastics extrusion, compound formulating, color matching, machine design and layout work, electrical circuits. Background in line supervision, personnel relations, technical service and sales liaison work. Prefer small to medium-size growing organization where past record of versatility and adaptability can be fully utilized. Reply Box 70855, Modern Plastics.

VINYL CHEMIST, B.S.: Age 34, 12 years experience in formulation, evaluation and competitive analysis in all phases of vinyl compounding. Dry blends and conventional extrusion compounds, plastisols, surface coatings, adhesives, sealers. Equally competent in production and development. Reply Box 73455, Modern Plastics.

INDUSTRIAL ENGINEER: 8 years' experience in engineering related to production of Vinyl Coated Fabrics, film and sheeting. Exp. includes planning of new calender facilities, development and design of finishing equipment. Impressive record of cost reduction. Presently employed as group leader with leading producer. B.S.M.E., 29, married. Desire engineering or production position with company in related field. Reply Box 71755, Modern Plastics.

PROGRESSIVE EXECUTIVE: Age 35, General Manager affiliate large West Coast molder and laminator. Previously assistant to president (treasurer and director) affiliated plastics company. Complete administrative experience in finance, production and sales provides an excellent background to assume a challenging managerial position or to assist a top executive in the execution of his duties. Will relocate. Full detailed references. Reply Box 72655, Modern Plastics.

HARD HITTING, COST MINDED, INJECTION-COMPRESSION MOLDING SPECIALIST with twenty years experience in all phases of plastic manufacturing desires to locate with small company where his know-how can be fully utilized. Has plant set-up experience, knows tools, machines, molding techniques and is able to take complete charge of operation. Available two weeks notice. Might consider investing in small company. Reply Box 70955, Modern Plastics.

SALES SERVICE or RESEARCH DIRECTOR: Desire connection with expanding firm to utilize both business and technical training. Extensive successful exp. in directing research, technical sales service and engineering applications for plastics and in training men for these fields. Reply Box 71455, Modern Plastics.

SALES AGENTS WANTED

SALESMEN—MANUFACTURER REPRESENTATIVES with following calling on industries .or .accounts .interested .in VACUUM or DRAPE formed parts of plastic sheet materials. Also pressure or matched metal mold parts. Commission basis. Write FOX VALLEY PLASTICS CORPORATION, 218-220 North Broadway, Aurora, Illinois for full particulars and protected territories available.

SALES REP. FOR BELGIAN MOLDS
Belgian company specializing in molds for plastics and in dies for stamping and punching, wish to expand their sales in the U.S.A. Highest grade guaranteed, to U.S. Standards. Selling agents interested in this line should write, stating qualifications and territory covered, to LEON G. RUCQUOI, Technical and Economic Consultant, 30 Rockefeller Plaza, New York 20, N. Y.

SALES REPRESENTATIVE WANTED by manufacturer having extruding and precision small parts centerless grinding facilities. Seeks representative with industrial contacts. Reply giving experience and present lines to Box 72955, Modern Plastics.

SALES REPRESENTATIVE: Chemist or Chemical Engineer with at least 2 years Vinyl extrusion experience, for sales of Polyvinyl Chloride Resin in the midwest. Will be fine opportunity for right man, with expanding organization. Furnish personal information, experience and salary desired. M. L. Hurr, Personnel Manager, THE GENERAL TIRE & RUBBER COMPANY, Akron, Ohio.

MISCELLANEOUS

MANUFACTURER'S AGENT now covering states of Ohio, Indiana, and New Jersey would like exclusive territory for line of equipment allied with the rubber and plastics industry. Mechanical engineer with 15 years' experience on rubber and plastics working machinery. Reply Box 72455, Modern Plastics.

SALES REPRESENTATIVE: Established New York City sales office, centrally located, covers New York, New England, New Jersey, Pennsylvania, Delaware, Maryland, Virginia. Sales on commission basis. Young, dynamic organization, currently expanding, interested in new lines of reinforced plastics, extrusions, protective coatings; also, required responsible custom molder for industrial accounts. If you want aggressive sales representation contact Box 71655, Modern Plastics.

FOR SALE: U.S. Patent covering Plastic and Metal Can Opener for Condensed Milk, Fruit Juices, etc. Good Injection Mold: about 30,000 Assembled and partially assembled units; Good Mail order and Chain item; 4 samples sent postpaid for $1.00. Will sell complete for $2000.00. MECO INC., Napoleon, Ohio.

INDEX OF ADVERTISERS

JULY, 1955

TELL U.S.I

when you need Polyethylene

PETROTHENE* polyethylene resins have been in commercial production since late March. Yet at this early stage, production specifications that call for high and consistent quality are already being consistently met. Petrothene's properties of good color, uniform melt index, low fisheye count and high tensile strength have aroused considerable interest among those who have run test evaluations.

PETROTHENE polyethylene resins meet a wide range of specifications for extrusion and injection or compression molding of a great variety of articles.

When next you review your polyethylene requirements, talk with U.S.I.

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U.S.I. INDUSTRIAL CHEMICALS CO.

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MODERN PLASTICS

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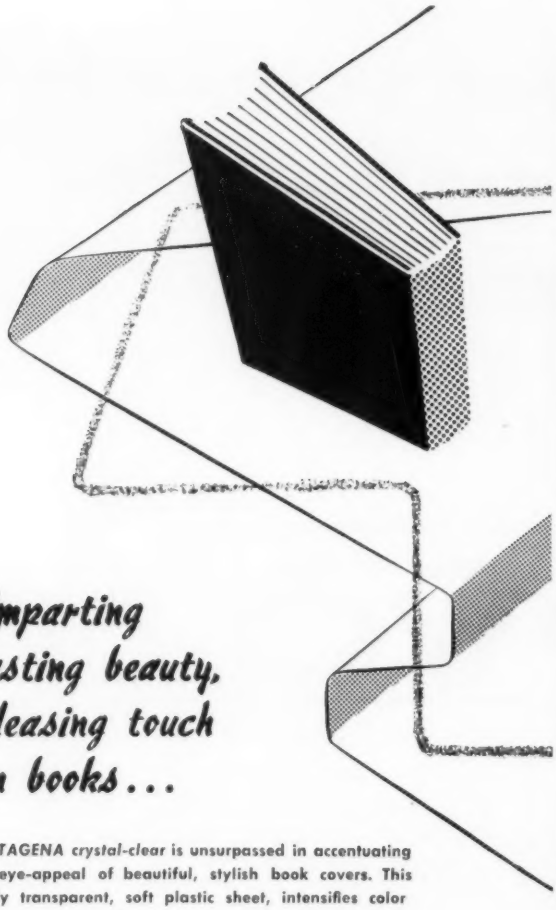


Imparting lasting beauty, pleasing touch on books...

GUTTAGENA crystal-clear is unsurpassed in accentuating the eye-appeal of beautiful, stylish book covers. This highly transparent, soft plastic sheet, intensifies color effects—preserves that look of newness. The caressing touch of its glossy surface conveys a pleasant sensation to the reader. GUTTAGENA crystal-clear is available in different gauges and degrees of hardness. It can be laminated, pasted, and sealed with simple high-frequency equipment. GUTTAGENA crystal-clear is extremely tough and pliable—doesn't crack or split—withstands heavy mechanical strain and chemical reaction.

Publishers and public libraries throughout the world have taken advantage of these outstanding properties.

GUTTAGENA soft sheeting for book covers is obtainable in a full standard range of fashionable colors and grains such as Haut, Juchten, Taft, Saffian, Perlsaffian, Tetuan and Bison.

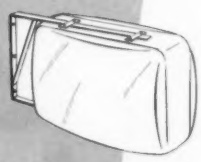
GUTTAGENA plastic cardboard is admirably suited for reinforcing book covers.

This is just one out of the many applications of GUTTAGENA which will help you increase your sales figures.

Full information of GUTTAGENA, and how and where to use it will be gladly supplied on request. ANORGANA engineers will be pleased to give you any technical advice on your plastic problems.

ANORGANA G·M·B·H · GENDORF/OBB· GERMANY

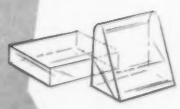
YOU CAN SAVE BY SWITCHING TO MIDLON



If your plastic costs are excessive . . . check with Midwest, the nation's largest and oldest exclusive extruder of thermoplastic sheet.

Here at Midwest, specialization has paid off . . . not only in quality of product but also in lowered costs. This experience coupled with volume has saved thousands of dollars for many Midwest customers.

Price, quality or service . . . whatever your problem in plastics . . . there is a Midlon sheet to fit your needs precisely. That is why "Midlon or equal" so often appears in the specification sheets of major manufacturers.



Price and product information furnished promptly upon request.

MIDWEST
PLASTIC PRODUCTS COMPANY
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Chemicals you live by

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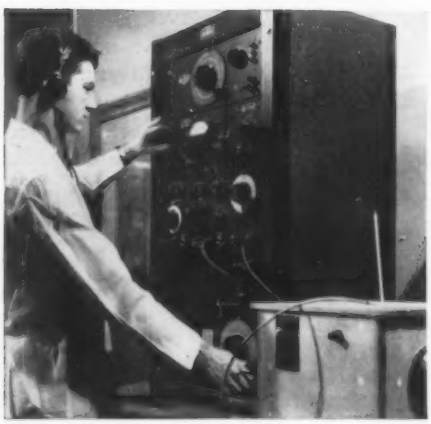
Diamond PVC-50

meets UL Standards



Measuring dielectric constant and power factor of DIAMOND PVC-50 *coated wire at the well-equipped plastics laboratory in the* DIAMOND *Research Center.*

DIAMOND's versatile, high-quality, dry-blending vinyl resin, PVC-50, has been accepted for interchangeability in all vinyl compounds listed by Underwriters' Laboratories, Inc.

The DIAMOND Research Center also has developed—and Underwriters' Laboratories, Inc., has found acceptable—formulas for compounds incorporating DIAMOND PVC-50. They meet the T and TW Building Wire Specifications and the 80 C Appliance Wire Specifications.

Now, wire coaters and users of vinyl resins for electrical applications have a dependable new source of high-quality, proved resin. DIAMOND Technical Service Representatives will be glad to work with you in adapting DIAMOND PVC-50 to present insulative compounds or in applying DIAMOND's formulas to your processes.

For information, write DIAMOND ALKALI COMPANY, Plastics Division, 300 Union Commerce Building, Cleveland 14, Ohio.

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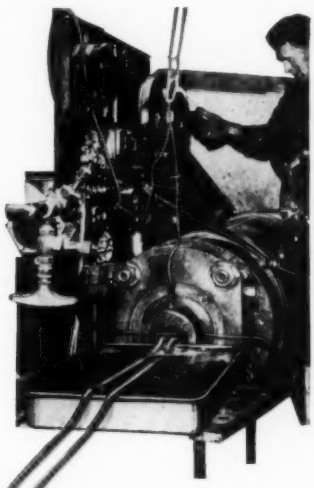
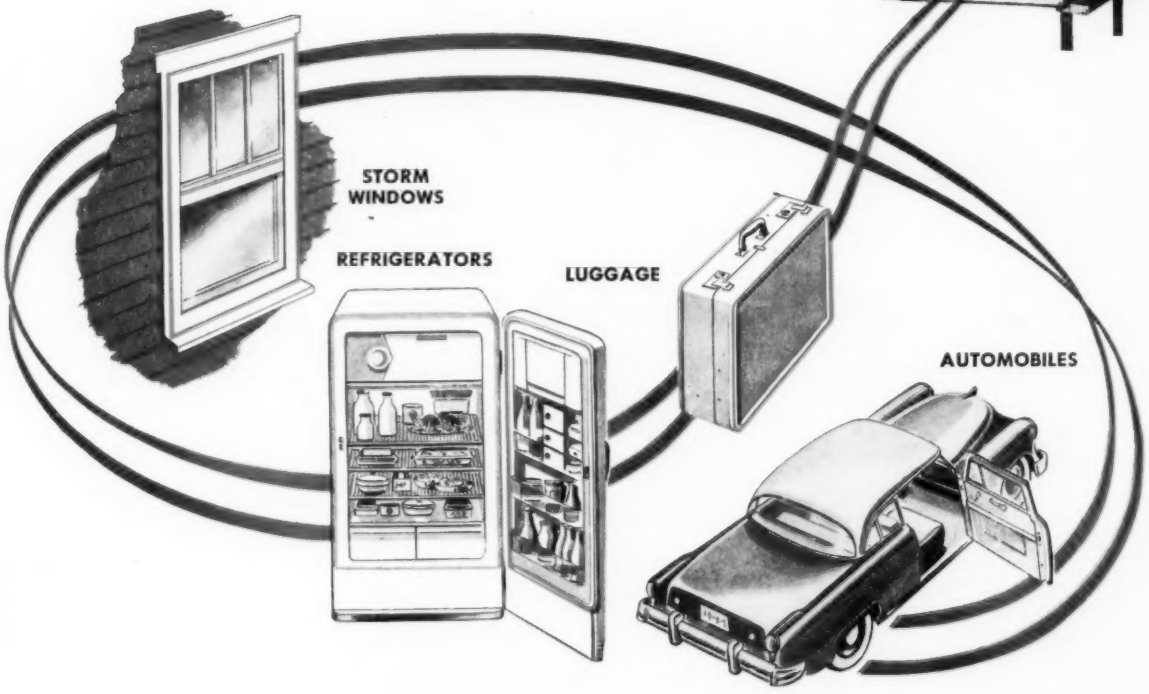
Pittsburgh PX Plasticizers add *Versatility* to your Vinyl EXTRUSIONS





WHERE you work, where you live, where you travel . . . you see more and more vinyl extruded products in use every day. Their exceptional ability to conform in shape, size and color to end product use is just one reason for their rapidly growing popularity. In addition, they offer unusual resistance to chemicals and aging, excellent shape retention and easy workability.

Formulating—and retaining—these desirable properties in vinyl plastic extrusions calls for the use of plasticizers with outstanding permanence and flexibility characteristics. To achieve these qualities, the Auburn Button Works, Inc., Auburn, New York, uses Pittsburgh PX Plasticizers in its extruded products and in many other high quality vinyl products. From experience, Auburn knows the benefits of buying from a basic producer. *And Pittsburgh is basic.*

We quality-control every step of plasticizer production from coal to finished plasticizer. *You* benefit by the assurance of top uniform quality in every drum, tank truck or tank car shipment. If you'd like to enjoy benefits like these, call one of our representatives in Pittsburgh, New York, Cleveland or Los Angeles. He'll welcome the opportunity to discuss your problems and make money-saving recommendations.

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